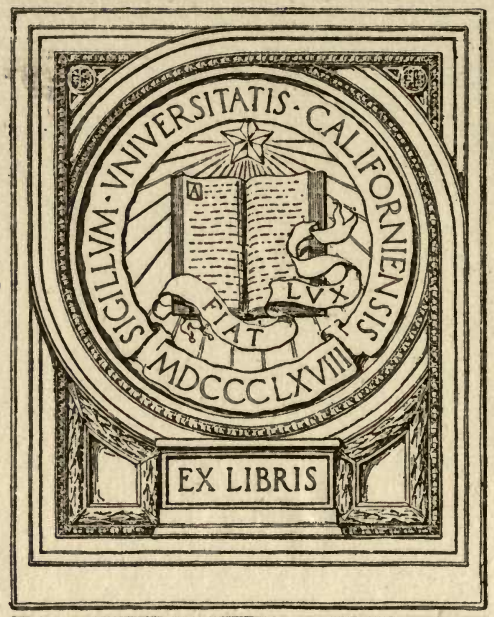
BIRD FRIENDS

A·COMPLETE·BIRD·BOOK FOR·AMERICANS

GILBERT·H·TRAFTON



BIOLOGY
LIBRARY
G

Books by Gilbert H. Trafton

PUBLISHED BY

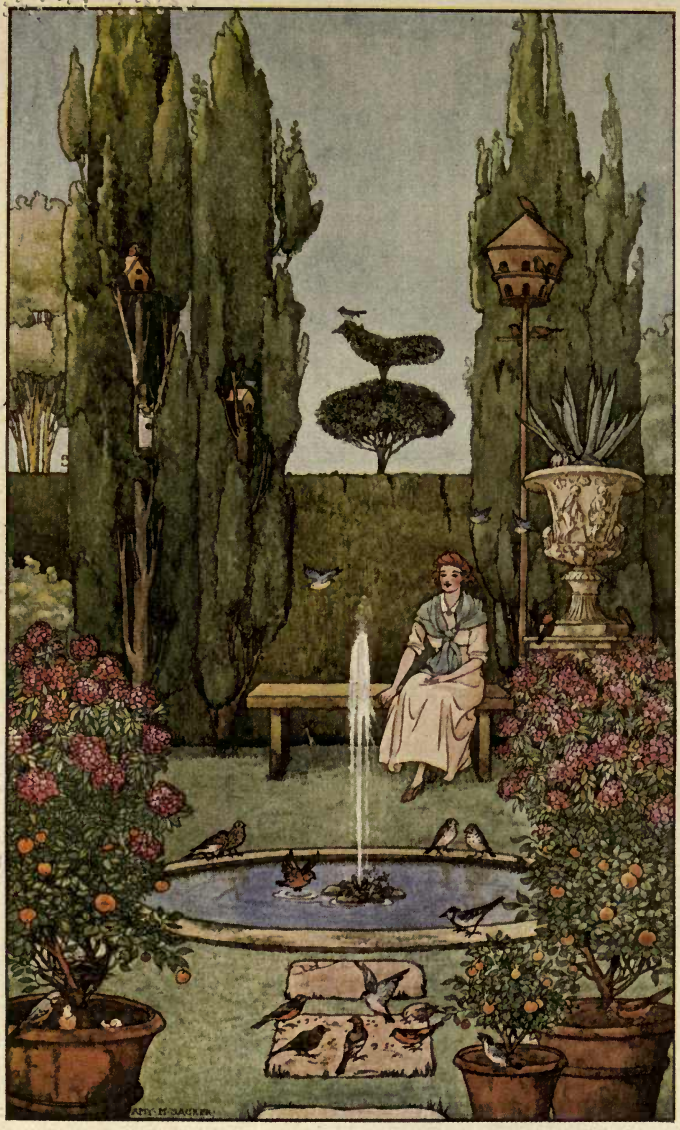
HOUGHTON MIFFLIN COMPANY

BIRD FRIENDS. Illustrated.

METHODS OF ATTRACTING BIRDS. Illustrated.

BIRD FRIENDS

UNIV. OF
CALIFORNIA



A BIRD GARDEN

BIRD · FRIENDS

A COMPLETE BIRD BOOK FOR AMERICANS by

GILBERT H. TRAFTON

WITH ILLUSTRATIONS

BOSTON AND NEW YORK
HOUGHTON MIFFLIN COMPANY
The Riverside Press Cambridge.

UNIV. OF CALIFORNIA

BIOLOGY
LIBRARY
G

COPYRIGHT, 1916, BY GILBERT H. TRAFTON

ALL RIGHTS RESERVED

Published September 1916

TO

MY SON LEROY

PATIENT, CHEERFUL, UNCOMPLAINING
DURING LONG-CONTINUED AFFLICTION

THIS BOOK IS AFFECTIONATELY
DEDICATED

364842

PREFACE

THESE pages are written, not only for the bird-lover, but also for the general reader who has no special interest in birds, but who is interested in those matters that pertain to community welfare.

Most of the topics presented in this book have been treated in an entertaining way in many excellent bird books, but most of these books cover only one or two phases of bird life, so that a person desiring to be generally informed on birds must secure several books. The bird enthusiast is glad to do this, but not the average citizen, who has no more interest in birds than in many other topics. It is highly desirable that every citizen should be informed on the need of conserving bird life as one of our valuable national resources. It has been the purpose of the author to gather within one set of covers a brief discussion of the essential facts concerning bird life that are of general interest, which are now scattered through many books, bulletins, and magazines.

One of the most interesting developments of the past few years has been the rapid strides made in the cause of bird-protection. Much of this work has been of such recent origin that information regard-

ing these various protective agencies and their work can be found only in recent periodicals. An effort has been made in these pages to bring together some of the more valuable of this material.

The author has also presented for the general reader a brief summary of the investigations of the food habits of our common birds, made by the Bureau of Biological Survey, the reports of which were originally published in bulletins to which most readers do not have access.

The author has had especially in mind one large group of readers, who have something of a professional interest in this subject, namely, the teachers of the country, who are now teaching children about birds in nature-study and through bird clubs. The last chapter has been specially prepared for their use, in the hope that it may prove helpful to them in teaching this subject to children.

The author acknowledges his indebtedness to those who have so kindly looked over portions of the manuscript and given suggestions thereon: to the Bureau of Biological Survey for looking over Chapters VII to XI inclusive; to Mr. Ernest Ingersoll for reading Chapters XVI, XVII, and XVIII; to Mr. Edward H. Forbush for reading Chapters I to VI, inclusive, and XII to XV, inclusive; and to Miss Helen M. Reynolds for suggestions on Chapter XXIII. Special thanks are due to Mr. Forbush for his courtesy in sending advance sheets of his annual

reports and of his bulletin on the Domestic Cat, from both of which much valuable material was obtained.

The entire manuscript has been read by Mr. Francis H. Allen, who has given many valuable suggestions.

G. H. T.

MANKATO, MINN.

CONTENTS

PART I

The Value of Birds

A. Their Æsthetic Value as a Subject for Study

I. Bird Travelers 1

Discovery of America — Changes due to migration — Regularity of migration — Distances birds travel — Winter homes — Speed and height — Routes of migration — How birds find their way — Causes of migration.

II. Bird Music 13

Why birds sing — Season of song — Time of day of song — Music of songs — Methods of recording songs — Similarity to human music — Classification of songs — Variations in songs — Call-notes.

III. Bird Homes 26

Time of building — Location of nests — Materials — Shape — Time occupied in building — Nesting-habits of cowbird — Number of broods — Change in nesting-habits.

IV. Home Life of Birds 33

Eggs — Incubation — Condition of young when hatched — Feeding young — Brooding young — A house wren's day — Care after leaving nest — Enemies of nestlings.

V. Colors and Plumage of Birds 44

Moulting — Change due to wear — Changes in color — Differences due to sex — Protective coloration.

VI. How to Know the Birds 48

Attractions of bird-study — Identification of birds — Where to find birds — When to find birds — How to study birds — What to study — Bird-photography — Table of fifty common land-birds.

B. Their Economic Value

VII. Friends among the Birds as Destroyers of Insect Pests 63

Bureau of Biological Survey — Methods of determining food of birds — Harm done by insects — Nature's check on insects — Service performed by birds — Amount of food eaten by birds — Value of nestling birds — Control of insect outbreaks — Division of labor — Birds of a Maryland farm — Birds and human health.

VIII. Friends among the Birds as Destroyers of Weed Seeds 84

Harm done by weeds — Characteristics that make weeds troublesome — Birds as destroyers of weed seeds — Amounts of weed seeds eaten — Effect on weed-patches.

IX. Birds as Destroyers of Rodent Pests . . 91

Harm done by rodent pests — Value of hawks and owls — Study of food of hawks and owls — Classification of hawks and owls — Money value of hawks and owls.

X. Foes among the Birds 99

Fruit-eaters — Injury to grain — Destruction of poultry — Damage to trees and wood products — Destroying beneficial insects — Injury to valuable birds — Preventing depredations of birds.

XI. Striking the Balance 110

Harmful birds — Neutral birds — Beneficial birds — Table of food of birds.

PART II

Enemies of the Birds

XII. Changes in the Numbers of Birds . . . 116

Extinct birds — Species in danger of extermination — Decrease of game-birds and shore-birds — Have song-birds decreased?

XIII. The Natural Enemies of Birds 128

Four-footed enemies — Feathered enemies — The elements.

XIV. Bird Enemies Introduced by Man: The Cat and the English Sparrow 135

The Cat.

Method of doing harm — Opinions of bird-students — Number of birds killed by cats — Cats as disease-carriers — Remedies.

The English Sparrow.

Ways in which it is harmful — Remedies: — Shooting — Poisoning — Trapping.

XV. Man as an Enemy of the Birds 161

Advance of civilization — Shooting for sport — Shooting for market — The milliner's trade — Egg-collecting — Remedies.

PART III

Bird-Protection

A. Protective Agencies

XVI. Work of the Audubon Societies 174

History of the Societies — American Ornithologists' Union — Work of National Association of Audubon Societies:

Legislation — Warden work — Egret-protection — Publications — Junior Audubon classes — Field agents.

State Societies.

XVII. Bird-Protection by Governments — State and National 188

Work of State Governments:

History of legislation — Model law — Bird day — Laws for game-birds — Summary.

Work of National Government:

Bureau of Biological Survey — Lacey Act — Migratory bird law — Tariff regulations — Bird reservations.

XVIII. Bird Clubs 209

Meriden Bird Club — Brush Hill Bird Club — Burroughs Nature Club — Liberty Bell Bird Club — Private game preserves — Summary of results in bird-protection.

B. Attracting Birds

XIX. Nesting-Boxes 223

Reasons for attracting birds — Birds using boxes — Types of houses — Imitation both inside and outside — Imitation outside only — No attempt at imitation — Entrance opening — Putting out the house — Martin-houses — Open Houses — Nesting-material — Dealers in apparatus to attract birds.

XX. Feeding the Winter Birds 249

Reasons for feeding birds — Birds to expect — Kinds of food — Methods of putting out food — Difficulties.

XXI. Fountains and Shrubs for the Birds . . 260

Fountains:
Essentials — Location — Plans for fountains — Fountains on lawns — Visitors at fountains.
Shrubs:
Planting for shelter — Planting for nesting-sites — Planting for food.
Calendar for attracting birds.

XXII. Domestication of Wild Birds 271

Success achieved — Methods of rearing wild birds — Rearing the bob-white — Rearing ducks — Attracting wild ducks.

PART IV

Bird-Study in Schools

XXIII. Teaching Bird-Protection in the Schools . 279

Purposes of bird-study — Materials for bird-study — Hand work — Bird games — Bird calendar — Using children's activities — Field trips — Bird clubs — Bird day — Relation of bird-study to other subjects — Essentials of a good lesson — A type lesson — Outline of bird-study by grades and seasons — Series of lessons.

Bibliography 317

Index 321

ILLUSTRATIONS

A Bird Garden . . . . . *Colored Frontispiece*
From a drawing by Amy M. Sacker

Bluebirds, Male and Female 4
From a drawing by Louis Agassiz Fuertes

Robin Singing 16
From a drawing by Louis Agassiz Fuertes

Long-billed Marsh Wren at Nest 26

Inside of House Wren's Nesting-Box 26

Young Green Herons in Nest 30

Two-Storied Nest of Yellow Warbler, showing cowbird's egg sealed in lower story 30

A Wren Mother and Her Family 38

Mother works while Father sings. Pair of House Wrens 38

Baltimore Orioles, Male and Female 46
From a drawing by Louis Agassiz Fuertes

Towhee, or Chewink, Male and Female (*colored*) . 50
From a drawing by Louis Agassiz Fuertes

Red-headed Woodpecker (*colored*) 54
From a drawing by Louis Agassiz Fuertes

Specimen Leaf from a Bird Notebook 58

A Useful Citizen. House Wren 66

Diagram of Food of Adult House Wren 66
From Yearbook of Department of Agriculture for 1900

Downy Woodpecker (*colored*) 74
From a drawing by Louis Agassiz Fuertes

Fox Sparrows, Eaters of Weed Seeds 84
From a drawing by R. Bruce Horsfall

Goldfinch (*colored*) 88
From a drawing by Louis Agassiz Fuertes

Screech Owl 94
From a drawing by R. Bruce Horsfall

English Sparrows, Male and Female 100
From a drawing by Louis Agassiz Fuertes

Cat with Robin 136
From a photograph by William Lovell Finley

A Cat that does not kill Birds 136
From a photograph of a cat owned by Prof. Burt G. Wilder

Young Egrets left Fatherless and Motherless by Plume-Hunters 168
From a photograph reproduced by permission of the National Association of Audubon Societies

Red Squirrel, a Nest-Robber 168
From a photograph by Dr. R. W. Shufeldt

Bird Island, Florida. Reservation owned by the National Association of Audubon Societies . . 186
From a photograph by C. E. Baynard reproduced by permission of the National Association

California Murres on Three Arch Rocks off the Oregon Coast, one of the Government Bird Reservations 186
From a photograph by William L. Finley and H. T. Bohlman

John Burroughs at the Dedication of "Wren's Nest" in Atlanta, Ga., by the Burroughs Nature Club . 214
From a photograph by Albert H. Pratt

Field Day in Renwick Woods, Ithaca, N.Y. Mr. L. A. Fuertes addressing the Cayuga Bird Club . . 214
From a photograph by Arthur A. Allen

Longitudinal Sections of Woodpecker's hole and of Von Berlepsch Nesting-Box 228
From Hiesemann's "How to Attract and Protect Wild Birds"

Natural Nesting-Site of a Flicker in an Old Apple Tree 228

Three Types of Nesting-Boxes 232
From a photograph by J. R. Snow

Open Nesting-Boxes for Robin and Phœbe . . 232
From a photograph by J. R. Snow

Bluebird at Entrance to Nesting-Box 236

House Wren and Tomato-Can House 236

Tree Swallow at Nesting-Box 236
From a photograph by W. H. Phillips

Martin-House accommodating Five Thousand Birds 236
From a photograph by C. E. Hamilton

Screech-Owl in Nesting-Box 244
From a photograph by E. H. Forbush

Song Sparrow at Lunch-Counter 250

Downy Woodpecker at Lunch-Counter 250

Chickadee feeding from Hand 250

Hermit Thrush at Lunch-Counter 250

A Bird's Tepee, made of Bean-Poles with the Vines still attached 250
From a photograph by Frank M. Chapman

A Self-Supplying Feed-Box 250
From a photograph by Edwin C. Brown

Suet-Baskets 254
From a photograph by J. R. Snow

Red-Breasted Nuthatch, perched on Hand . . . 254
From a photograph by Laurence J. Webster

White-Breasted Nuthatch, feeding from Hand . 254
From a photograph by Edwin C. Brown

Shelter for Birds' Food. Fifteen birds feeding,—Song Sparrows, Tree Sparrows, Juncos . . . 258
From a photograph by William C. Horton

Window and Moving Food-Shelves 258

Bob-White reared in Captivity 262
Reproduced by permission of the National Association of Audubon Societies

Concrete Bird Fountain on the Author's Lawn . . 262

School Bird Calendar 284
From a photograph by A. D. Whedon

Feeding-Station for Birds in Yard of Training-School, Mankato State Normal School, Minnesota 284

School Bird Fountain, Passaic, N.J. 292

Junior Audubon Class at Training-School, Mankato, Minn. 292
From a photograph by A. D. Whedon

The illustrations, except as otherwise stated, are from photographs by the author.

BIRD FRIENDS

UNIV. OF CALIFORNIA

BIRD FRIENDS

CHAPTER I

BIRD TRAVELERS

Discovery of America. The subject of bird migration is of special interest to Americans, because it is probable that migrating birds aided Columbus in the discovery of America. During the latter part of his voyage, when his sailors were beginning to mutiny, he fell in with flocks of birds which were making their annual flight from the Bermudas to the Bahamas. Columbus followed these birds and was thus guided to land. Otherwise it is quite possible that he could not have induced his sailors to continue farther, and thus the discovery of America would have been postponed.

Recent records of migration. During recent years, there has been kept at Washington a very complete record of the facts of migration, relating to the times and routes of migration and to the winter homes of birds. For more than twenty years these records have been collected by the Bureau of Biological Survey, through the coöperation of over two thousand bird students throughout North America, so that now they have a large array of

reliable data regarding bird migration, comprising over a half-million records.

Changes due to migration. The conspicuous seasonal changes in bird life which occur regularly every year are due to bird migration. Birds may be divided into four groups in accordance with the portion of the year that they remain in a given locality. Permanent residents remain in a locality all the year. In the cold Northern States these include such common birds as the blue jay, nuthatch, chickadee, downy woodpecker, goldfinch, and a few others. Farther south the list becomes longer.

Summer residents remain for the summer only, during which season they are nesting. They spend the winter in regions farther south. Most of the common birds found during the summer in the northeastern section of the United States belong to this group, such as the oriole and the house wren.

Winter residents are found in a locality only during the winter, the summer being spent in regions farther north. In the Northern States, this group includes such birds as the winter wren, snow bunting, tree sparrow, redpoll, and red-breasted nuthatch.

Transient visitants are birds which are seen for a few weeks in the spring and again for a few weeks in the fall as they are migrating. These birds spend the winter farther south and the summer farther north, and are seen only when passing through, on

their way to and from their breeding-grounds. Many warblers belong to this group. The birds which belong in each of these four groups vary according to the locality.

The general changes in bird life due to migration which occur annually in any locality may be briefly summarized as follows: During the winter months the birds found in a locality belong to the permanent residents and winter residents. For several months there is little change in the kinds of birds seen. But beginning with the early spring the migration commences, the exact date varying with the latitude and the weather. New birds continue to come in large numbers up to the middle or last of May, some remaining for the summer and others passing farther north. Meanwhile the winter residents have been leaving. Then follows the breeding-season, and for several months there is little change in the kinds of birds seen. About the first of September the fall migration begins, extending into November, the birds gradually leaving for the South, slipping away so quietly that they may be gone for some time before their absence is noted. In the late fall the winter residents arrive, and bird life settles down again to the winter quiet. Thus this annual change occurs year after year with great regularity.

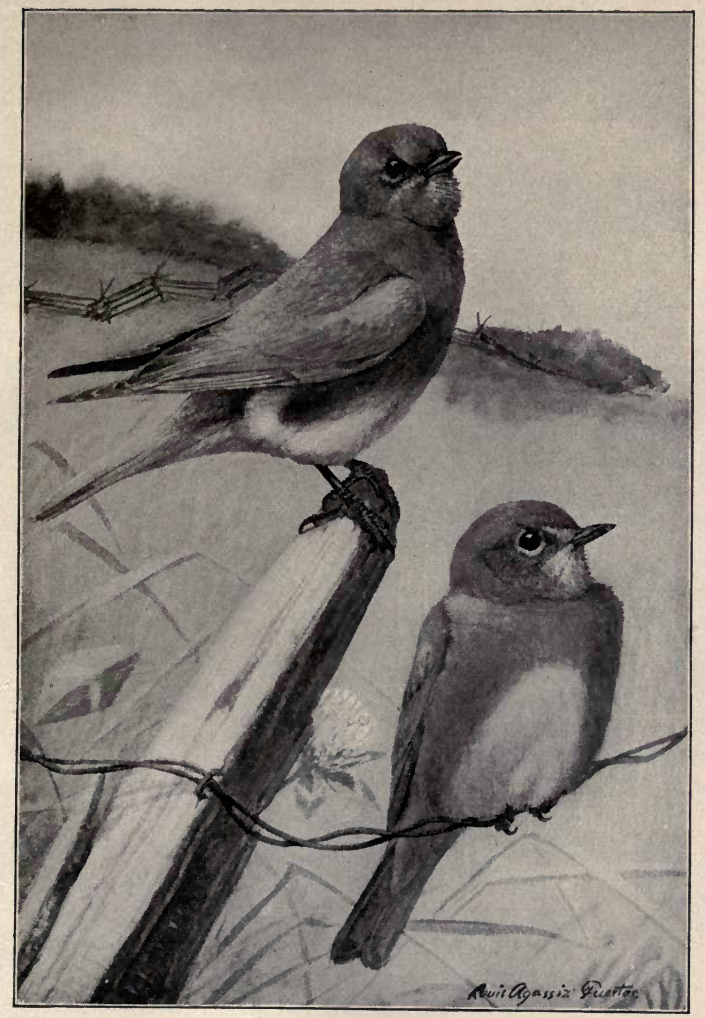
Regularity of migration. The time at which each species of bird arrives at a certain place varies little

from year to year for most birds. The date when the early migrants arrive may vary considerably according to the season, but the dates for the later migrants are fairly constant.

The order in which the various birds arrive is also well fixed. Certain birds are always among the first migrants regardless of the season, such as the robin and the bluebird, and other birds are always among the last migrants to arrive, such as the indigo bunting and wood pewee, and this order remains about the same from year to year.

Distances. The distances that birds migrate vary greatly with the species. Some birds may migrate southward only a few miles; others travel farther, to the Southern States; and over a hundred species leave the United States. Some winter in Central America, some in the northern part of South America, and still others in the southern part of South America. Some warblers which nest in Alaska probably travel to Brazil, a distance of seven thousand miles.

Golden plover. The two most noted travelers among birds are the golden plover and the Arctic tern. The golden plover nests along the Arctic coast of North America. It then proceeds to Labrador and Nova Scotia, and from here it may make a continuous flight, in pleasant weather, of twenty-four hundred miles, to the coast of South America. It then passes on to Argentina, where it spends the



BLUEBIRD

Upper, male; lower, female

UNIVERSITY OF CALIFORNIA

winter. It returns north by a different route, passing along the western part of South America and through the United States by the Mississippi Valley, and thence to the northern coast of North America, its nesting-site, a distance of eight thousand miles from its winter home.

Arctic tern. The Arctic tern has even a longer range of travel than the golden plover. Some of these birds breed along the Arctic coast of North America, a nest having been found within seven and a half degrees of the North Pole. Its winter home is eleven thousand miles away, within the Antarctic Circle, within sixteen degrees of the South Pole. Thus the bird flies almost from pole to pole, twice a year, a journey of twenty-two thousand miles, a distance nearly equal to the earth's circumference. Mr. W. W. Cooke points out that, as a result of being near the poles for so much of the year, it lives for about eight months in regions of perpetual sunshine, and during the rest of the year its days are much longer than its nights. It might well be called the bird of sunshine.

Winter homes. As one watches the birds in their flight, it is interesting to think of the countries from which they have come, and of the varied scenery which their keen eyes have looked upon. The hummingbird that visits our garden flowers has seen the Panama Canal; the Baltimore oriole that swings its nest from our elm trees has seen the Andes in

Colombia; the rose-breasted grosbeak spends his winter just over the equator in Ecuador; the kingbird has perhaps flown above the waters of Lake Titicaca in Bolivia and Peru; the bobolink has traveled from Paraguay to build his nest in our meadows; the red-eyed vireo has visited the coffee plantations of southwestern Brazil; the barn swallow that builds his mud nest in our barns will return to the Pampas in Argentina for his winter sojourn; while some of the nighthawks that nest in Alaska may travel to the southern part of South America, to Patagonia, a distance of about seven thousand miles and of about one hundred and fifteen degrees of latitude.

Speed. The speed with which birds migrate varies with different species of birds and with the same species of bird in different parts of its journey. In general, birds travel faster during the latter part of their journey than during the first part. During the first part of March, the robin averages thirteen miles a day in migrating from southern Iowa to central Minnesota. From here its speed keeps increasing till it is traveling at the rate of seventy miles a day when it reaches Alaska by the middle of May. The robins along the Atlantic Coast travel more slowly, at the rate of seventeen miles a day.

The average speed for all species of birds is twenty-three miles per day from New Orleans to southern Minnesota. From this locality some spe-

cies travel northward at the rate of forty miles a day, and still farther north some at seventy-two miles, others at one hundred and sixteen miles, and five species, on arriving in Alaska, are traveling at the rate of one hundred and fifty miles a day.

The figures here given are for the species as a whole, not for individual birds. Usually birds migrate only a few hours during the night and then rest for a day or two, so that the average rate at which a species migrates is much less than for an individual bird. Our common small birds probably travel at the rate of about thirty miles an hour while migrating; ducks and geese may travel at the rate of forty-five miles an hour. Thus during a single night birds may travel from two hundred to four hundred miles.

Daily time of migration. Some birds migrate by day, some by night, and some both by day and night, but most are night travelers. The time selected by a bird for migration depends on its power of flight, its method of procuring food, and its disposition. The warblers, vireos, and thrushes migrate by night, the swallows and hawks by day; while ducks, shore-birds, and sea-birds migrate both by day and night.

Routes. As birds travel between their winter and summer homes, it is found that they follow fairly well-defined routes. In the central United States the Mississippi Valley is the most common route,

and in the eastern United States, the coast-line. The route by which a bird travels north is usually the same as the one by which it returns south, although there are some exceptions to this rule.

When birds which are *en route* for South America reach the Gulf Coast of the Southern States, several routes are possible. A few birds pass from Florida and follow the chain of islands extending southeast — the Bahamas, Haiti, Porto Rico, and the Lesser Antilles — and thence to South America. A few fly from southern Florida to Cuba, thence to Jamaica, and then make the flight of five hundred miles from Jamaica to South America: the bobolink takes this route. A few birds, like the cliff swallows, follow along the coast of Mexico; but the great majority of species fly directly from the Gulf Coast of the Southern States across the Gulf of Mexico to the southern shore of the Gulf, a distance of from five hundred to seven hundred miles. From there the journey is continued through Central America to South America.

Another route much used by water-birds extends from Nova Scotia to the Lesser Antilles and the northern coast of South America. It was the birds which were migrating along a portion of this route that guided Columbus to land.

How birds find their way. One of the puzzling problems of migration is how birds find their way during these long journeys. On June 7, 1911, a

chimney swift fell through an opening in a chimney into a room of a house located in Meriden, New Hampshire. Mr. E. H. Baynes was in the room and placed on the bird a small numbered leg-band and let the bird go. About one year later, on June 15, 1912, a chimney swift again fell through the same hole into the same room, and when Mr. Baynes took up the bird he found it to be the same one he had banded the year before. This bird had traveled to Central America, spent the winter there, and then traveled back to the same town, and to exactly the same chimney it had occupied the previous year. How had it been able to find its way over this long route back to the same nesting-site?

Bird's sight. Many theories have been advanced to explain how birds find their way. Probably no one theory will satisfy all conditions. There are doubtless many factors needed to give a satisfactory explanation. One important factor is the bird's sight. Birds have very keen eyesight, and it seems probable that birds flying at a great height may be guided by conspicuous landmarks, such as mountain-chains, coast-lines, and river-valleys which extend in the same direction as the routes of migration. In North America, the coast-lines and mountain-chains and the Mississippi Valley extend in the general direction in which most of the birds migrate. But this explanation alone is not sufficient, as birds may migrate at right angles to these landmarks, and may find their

way in a fog when landmarks are invisible, or over large bodies of water where no landmarks can be seen; and frequently birds fly so close to the ground or water that they cannot see any landmarks. And again birds may travel straight for long distances over routes which they have never seen before.

Sense of direction. Still another suggestion is that birds have a sense of direction which enables them to find their way. This is simply ascribing a power to birds without any real explanation, but experiments which have been made with birds seem to show quite conclusively that some birds do possess this sense of direction. Several birds were captured on Bird Key south of Florida, and were placed in the hold of a steamship and taken north to Cape Hatteras, a distance of about one thousand miles from their nesting-sites, and released. Five days later, two of them were back on their nests. In this case no other explanation seems possible than that the birds found their way through a sense of direction, as the birds had never flown over this route before, and could not see the way over which they had come, and so could not make use of any landmarks.

Causes of migration. The most puzzling of all questions concerning migration is, why do birds migrate? At the outset it may be stated that bird students are not agreed as to the causes of migration, but brief reference may be made to a few of the

theories which have been put forward at various times to explain the cause of bird migration.

Food and temperature. It is very commonly stated that lack of food and low temperatures cause birds to migrate. But even a very hasty examination of the facts shows that these do not explain migration. The fall migration begins during the late summer, when the temperature is still high, and at a time when insect life is abundant. Furthermore, during the spring migration, birds are traveling into regions where the temperature is lower and insect life is less abundant than in the regions which they are leaving. And again, some tropical sea-birds migrate from one section to another where the conditions of temperature and food-supply are practically the same.

Glacial theory. One theory relates the origin of bird migration closely with the glacial age. Fossils which have been found show that before this age North America had a warm climate, even in its northern portions. This climate must have been well adapted for bird life during all parts of the year. As the ice-sheet began to extend south, the birds were driven before it, and as it melted and receded north, the birds followed it back. In accordance with this theory, the habit which the birds thus acquired of moving back and forth, following the oscillations of the ice-sheet, was inherited eventually by the birds as an instinct and still exists to this day.

Physiological explanation. None of these theories is generally accepted by bird students as giving a satisfactory explanation of migration. It is probable that birds have a physiological instinct which prompts them to migrate in order to rear their young, just as their instinct leads to other actions, such as singing, mating, nest-building, egg-laying, and incubating. But this statement, of course, gives no explanation as to how and why this instinct originated.

CHAPTER II

BIRD MUSIC

Why birds sing. Of the many interesting sounds in nature, bird songs are the most charming. The song of birds is a sexual characteristic developed in the male during the nesting-season. It is closely related in the first place with mating, and is one means by which the male attracts the attention of the female during courtship; it continues, however, during most of the nesting-season. Occasionally the female has been known to sing, as with the rose-breasted grosbeak and cardinal. While singing is primarily a sexual instinct with the birds, yet it may probably be carried on for the æsthetic pleasure derived, as some birds seem to show appreciation of the harmony of music.

Season when birds sing. Spring and early summer is the season of bird song, but there is a great variation as regards the time when different species begin and end their song. The first birds that come in the spring begin to sing at once, so that the song season in the northern United States begins in March. The song of the later arrivals is added to these, till the height of the song season is reached in May. As the family cares begin to occupy the attention of the

birds, they become more wary and busy, so that during June the volume of bird music gradually becomes less as the birds drop out of the chorus one by one. During July there is a still more marked decrease, till by the end of the month nearly all the birds have ceased singing, although a few continue well through the summer, such as the house wren and red-eyed vireo. When birds rear two broods, this tends to prolong the song season.

Time of day when birds sing. The bird chorus begins in the early morning at earliest daybreak and reaches its climax about sunrise and then declines till it is nearly over by the middle of the forenoon, although a few birds, like the wren, sing nearly all day long. During the middle of the day most of the birds are quiet. The chorus begins again late in the afternoon and continues till some time after sunset. The evening chorus is not so vigorous and long-continued as the morning chorus, although some species of birds sing rather more in the afternoon than in the morning.

The birds do not all begin and end their morning song at the same time. Certain birds are usually among the first to begin, an hour or more before sunrise, such as the chipping sparrow, the robin, and the song sparrow, and as the morning advances other birds join the chorus. This order in which the different birds begin to sing is about the same from morning to morning.

Identification by song. Bird songs are of interest to mankind for two reasons: as a means of identifying the singer and as a source of pleasure on account of the musical harmonies produced, just as one enjoys human music. When the leaves on the trees have developed in the late springtime, it is often difficult to see the birds which may be behind the foliage. But if one knows the song of the bird, he can identify it without seeing it. It is a source of much pleasure to be able to recognize the voices of one's bird friends as he walks past their haunts.

Music of bird songs. But the feature about bird songs that appeals most strongly to one is their harmony, that reaches the musical sense which every one possesses in some degree. As one may plan to attend a concert to hear some of the fine musical productions of the human voice, so one may plan to attend the morning or evening chorus of the birds to hear some of the fine musical productions of the bird's voice. Each kind of music has its accompaniment. The human voice is usually accompanied by some instrument, which adds to the charm of the voice. The accompaniment of bird music is the natural surroundings in which it is rendered, the things that we associate with it. A beautiful sunset may be the accompaniment of the song of the vesper sparrow, a quiet wood on a hill-slope that of the hermit thrush, and a little tree-bordered brook that of the kinglet. These natural accompaniments are closely

interwoven with the songs and add greatly to our enjoyment of them.

Methods of recording bird music. Several plans have been used for describing and recording bird songs. People differ so much in their way of interpreting bird songs that no one method of description will be clear to all.

One of the simplest methods of recording bird songs is to use syllables sounding like the song of the bird. In some cases this works very well, as in the case of the chickadee and some other birds which have been named from their song. In other cases the attempts to describe the song by syllables are not so successful, as different syllables may be used by different people. Following are some examples of attempts that have been made to describe songs this way: —

Red-winged blackbird: *kong-quer-ree*, or *o-ka-lee*, or *gug-lug-eee*. These all agree in having three syllables and in having the last syllable end in *e*.
Maryland yellow-throat: *wichity, wichity*.
Flicker: *wick, wick, wick*.
Nuthatch: *quank, quank, quank*.
Oven-bird: *teacher, teacher, teacher*.

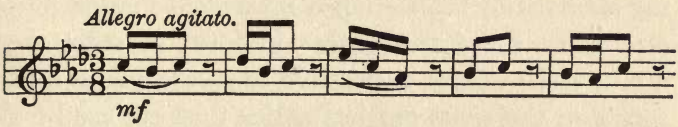
Another way of recording songs is to use a series of dots or dashes to indicate the number of syllables and the difference in pitch. The song of the chestnut-sided warbler might be represented thus: . . . . ˙ . This means that the song has

UNIVERSITY OF CALIFORNIA

ROBIN SINGING

six syllables and that they are all on the same pitch except the next to the last, which is higher than the others. The song of the robin may be represented thus: . . . . . This indicates that the notes are generally delivered in groups of three, with an occasional two-note group.

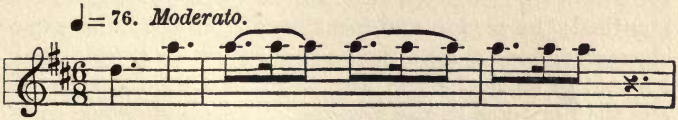
Still another method of recording bird songs is the attempt to write them on the musical scale used for human music. Following is a record of the robin's song in musical notation, as given by Mr. Schuyler Mathews in his "Field Book of Wild Birds and Their Music":—



ROBIN

In order that the three methods of recording bird songs may be compared, the song of the white-throated sparrow is given in each of these methods.

By syllables: *Old Sam Peabody, Peabody, Peabody.*
By dots: . . . . . .
By musical staff:—



WHITE-THROATED SPARROW
(The bird sings two octaves higher)

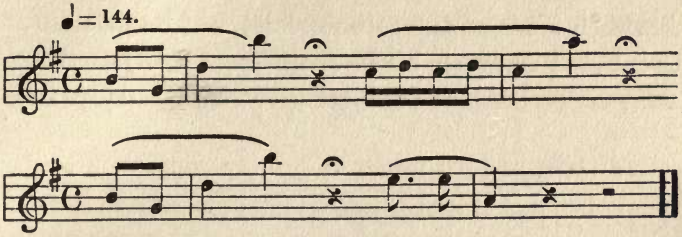
Described in words, this last means that first come two long tones of equal length, then three groups of triplets, each group being equal in length to one of the long notes; and in each triplet the middle note is the shortest, the first note being equal to three of these and the last note equal to two of them.

Similarity of bird music to human music. There is something of interest in the song itself as a musical production divested of its harmony and surroundings. Mr. Henry Oldys, who has made a special study of bird songs for a number of years, finds some interesting similarities between bird music and human music. First, the resemblances in form of structure are so close that it is possible to record many bird songs on the same musical scales that are used for human music.

Mr. Oldys writes: —

> One especially remarkable point of resemblance between bird and human music, however, cannot be too strongly emphasized. I have found the wood pewee and the wood thrush uttering songs, in some cases identical, in others nearly so, in structural form with many of our four-time ballads and hymns. This form is governed by the following unwritten rule: the first and third lines are identical; the second and fourth are identical in notes or character, except that the second ends with a note that leaves the musical sense suspended, and the fourth with one that satisfies it, the keynote. The wood pewee song follows this form strictly.

Mr. Oldys gives the following song of the wood thrush as illustrating this rule of the human ballad:—

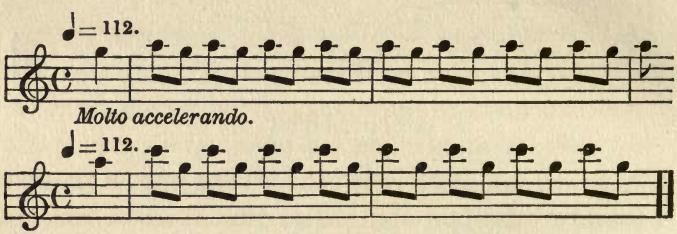


WOOD THRUSH

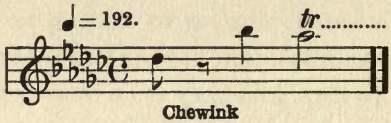
A second similarity between bird and human music is found in the fact that these two kinds of music have been developing along similar lines. Bird music to-day is very similar to human music in its earliest stages, and similar to the music of some primitive people to-day, and may even be superior to it.

Bird duets. A third similarity is shown in the fact that birds possess a musical taste and show appreciation of musical tones. Mr. Oldys cites cases where birds sing duets, one immediately following the other, where the second bird sings a theme which naturally follows and completes the theme of the first bird. The birds have been known to repeat these several times, each waiting till the other finishes. In some cases where two birds were singing unrelated themes, one bird has been known to change its theme so as to make it harmonize with the other's notes. This antiphonal form of singing has

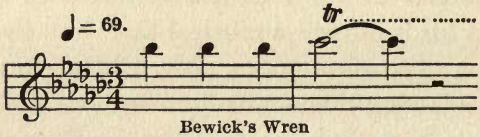
been observed especially among meadowlarks, but also among chickadees, chewinks, song sparrows, and field sparrows. These duets are usually sung between birds of the same species, but occasionally are heard between birds of different species. The following records of duets are given by Mr. Oldys: —



DUET OF TWO FIELD SPARROWS



Chewink

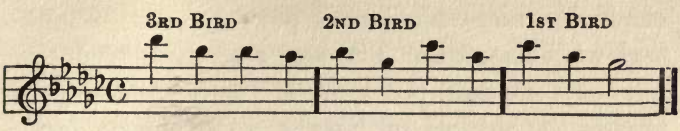


Bewick's Wren

DUET OF CHEWINK AND BEWICK'S WREN

Bird trios. Mr. Oldys also records a very unusual case of three meadowlarks singing a trio. Two larks were first singing unrelated phrases. One bird then changed its song to make it respond to that of the other, and after this was repeated several times, a third meadowlark cut in with a phrase related to

the other two and appropriately placed, and the three birds sang twice around this trio.



TRIO OF MEADOWLARKS

All these cases seem to show conclusively that birds do possess musical appreciation.

Classification of bird songs. It is extremely difficult to make a classification of bird songs that will appeal to all people in the same way, but the following crude grouping is suggested as hinting at some of the more conspicuous differences in bird songs: —

Instrumentalists. The first group might be called "instrumentalists," as they do not make the sound with the throat, but with the bill, wings, or an air-sac. In its general purpose, however, the sound made corresponds with the songs of the song-birds. The woodpeckers, the ruffed grouse, and the prairie chicken belong to this group. The woodpeckers produce their note by beating on a limb with their bills. The grouse produces its sound by beating the air with its wings. The prairie chicken produces his booming sound by means of air-sacs situated on the sides of the head.

Syllable songs. A second group of songs may include those which possess enough similarity to

spoken syllables so that the bird has been named from its song. In this group belong such birds as the chickadee, bob-white, wood pewee, chebec, phœbe, and whip-poor-will. The songs of these birds are not very musical, but some are rather pleasing, as that of the chickadee. No sharp line can be drawn between these songs and the whistle songs mentioned in the next paragraph, as some of these syllable songs possess the character of a whistle.

Whistle songs. In a third group may be placed most of the remainder of the song-birds which have a more or less complex song of a whistled character, many of which are very musical and pleasing.

Some songs are monotonous, like that of the chipping sparrow; others are varied, like that of the song sparrow. Some are ringing and loud, like that of the Baltimore oriole; others are soft and subdued, like that of the vesper sparrow. Some are unmusical, like that of the phœbe; others are musical, like that of the wood thrush.

Among the birds which deserve special mention, either on account of the variety or the pleasing quality of their notes, are the house wren, the Baltimore oriole, the rose-breasted grosbeak, the catbird, the brown thrasher, the goldfinch, the song sparrow, the vesper sparrow, the wood thrush, the veery, and the hermit thrush.

The wren's song consists of a warble without much variety, but very cheerful, and given almost

continuously during the day. The grosbeak has a pleasing warble reminding one of the robin. The brown thrasher's notes suggest an orchestra. The goldfinch has been well named the "wild canary." The song of the vesper sparrow has a subdued, restful character, frequently heard in the late afternoon. Probably the first place among the bird musicians should be given to one of the thrushes. There is a resonant, ringing, penetrating character about their notes that it is impossible to describe.

Mr. Wilson Flagg writes in his "A Year with the Birds":—

> The singing birds with reference to their songs are distinguishable into four classes: The rapid singers, whose song is uninterrupted, of considerable length, and delivered in apparent ecstasy, like the bobolink; the moderate singers, whose notes are slowly modulated, without pauses or rests between the different strains, like the robin and veery; the interrupted singers, who sometimes modulate their notes with rapidity, but make a distinct pause after each strain, like the red thrush and hermit thrush. The fourth class includes birds whose lay consists only of two or three notes, not sufficient to be called a song, like the bluebird and golden robin.

Variations in songs. A study of bird songs soon shows that while the songs of different birds of a given species are much alike in the rhythm, there is a great variation in different individuals in the notes used and in the excellence of rendering, so that the ear trained to bird music soon distinguishes

different robins and different orioles through their songs.

There may also be a variation in the song of any one individual, dependent on age and season. The first efforts of the young bird to sing are not so near the type of that species as those which he makes in later seasons. Again the song of the individual may change as the season progresses, the song becoming shorter and shorter till it ceases altogether.

Mr. Oldys reports that he has noted more than eighty different wood thrush phrases, and he says that song sparrows' phrases are more diverse than those of wood thrushes. A song sparrow has been known to render twelve distinct themes in fifteen minutes.

Individual differences are due, not only to the use of different phrases, but also to the way in which the phrases are rendered. There may be excellent rendering and poor rendering of the same phrase among birds, just as there are varying degrees of excellence among human voices.

Range of voice. A study of the records made of bird songs suggests the pitch and range for different birds. The tones of nearly all birds are high-pitched, ranging between two and four octaves above middle C. The range of voice in different species varies from three notes for the chickadee to two octaves for the hermit thrush. A number of birds have a range of about one octave.

Call notes. Besides their songs, birds also make sounds known as "call notes," which differ from their songs in about the same way that human language differs from human songs. These call notes probably serve the purpose of a language by which birds communicate. They are used by all birds, both male and female, and at all times of the year. Some birds have a great variety of call notes, each representing some emotion, such as a hunger call, given by the young birds in the nest; the lost call of a young bird after leaving the nest; the warning call given to the young to show no signs of life in the face of danger; the recognition call, by which individuals of the same species are brought together in flocks, especially during migration; and the rally cry by which other birds are brought to the spot. An observer of the crow has recorded twenty-seven distinct calls for this bird.

CHAPTER III

BIRD HOMES

Courtship. The nesting-season begins with the courtship of the birds, during which time the birds mate in preparation for the nest-building and the rearing of the young. The male is in full song at this time and frequently performs curious antics as a means of attracting the attention of a mate. In some cases it is probable that birds mate for only one season, while in other cases it is believed that this mating lasts for life. Some birds, such as pheasants, are polygamous. The author once watched a male red-winged blackbird which had three mates, each with a nest and young ones.

Distinguishing characteristics of nests. After the mating, the next step is the construction of the nest. Each species builds a characteristic nest similar to those built by its parents, so that it is possible from seeing a nest to tell the bird which made it. But while the nests of birds of the same species are quite similar, yet there are many individual variations within these limits set by the species. It is interesting to know that the first time a young bird builds a nest, it uses the same sort of material, makes the nest of the same shape, and constructs it in the same

LONG-BILLED MARSH WREN AT NEST

INSIDE OF HOUSE WREN'S NESTING-BOX

manner as did its parents before it, although it has never seen a nest built.

Time of building. There is a regular time and order in nest-building as there is in migration, although the order is not exactly the same. In any given locality certain kinds of birds begin to nest at about the same time each year; in some species the older birds beginning to nest before the younger ones. Certain birds, like the robin and bluebird, are always among the first to nest, and other birds, like the cedar-bird and goldfinch, are always among the last to nest, and this order of nesting remains the same from year to year. In the northeastern United States the first birds begin to nest in February (the great horned owl), the last begin the latter part of July (goldfinch), but May is preëminently the nest-building month. Some birds, like the robin, bluebird, and house wren, rear two broods, and this brings the nesting-season well along into the middle of the summer. The nesting-dates for a few common birds are given in the table on pages 61 and 62.

Location of nest. Nests are found in a great variety of places. Many birds nest on the ground. Some of these, such as the bob-white and bobolink, build their nests in open fields. Others, such as the ruffed grouse and hermit thrush, build their nests on the ground in woods. The oven-bird builds an arched nest with an entrance on one side. Some birds, such

as the red-winged blackbird and the marsh wren, build their nests among the reeds of marshes, a few feet from the ground. Still others, as the field sparrow, catbird, chipping sparrow, and many warblers, build in low shrubberies or small trees. Others, as the robin, wood thrush, and many hawks, place their nests in the crotches of trees; while still others, such as the hummingbird and chebec, saddle them on to branches. Others hang their nests from branches, as do the Baltimore oriole and the vireos. The chimney swift glues the sticks of its nest together and attaches it to the chimney by means of its sticky saliva.

Many birds nest in cavities in trees. Some birds, like the woodpeckers, drill these holes themselves. Other birds, such as the house wren, bluebird, and tree swallow, use holes which they find already made, either by woodpeckers or through decay.

Kingfishers and bank swallows dig tunnels in banks and rear their young here. These tunnels extend from three to eleven feet. At the end of the tunnel the swallow makes an enlargement and constructs a nest of straw and feathers, but the kingfisher usually makes no nest.

The question is often asked whether birds use the same nest more than once. Birds differ in this respect. John Burroughs divided birds into three groups. One group, as the bluebird, house wren, fish hawk, and eagle, repairs the last year's nest.

A second group, including the phœbe, builds a new nest each season, but may rear more than one brood in the nest. A third group, which includes most of our birds, builds a new nest each year and for each brood when more than one is reared.

Materials. Birds use a great variety of materials in the construction of their nests. Among the more common materials are dry grass, rootlets, small twigs, and hair. Robins and barn swallows use mud. The Baltimore oriole uses string, yarn, and hair. The catbird uses strips of bark from the grapevine. The house wren fills its nesting-cavity with small twigs. The phœbe constructs its nest of mosses and mud. Many nests contain materials which man has indirectly furnished, such as strings, yarn, pieces of cloth and of paper.

The nest is usually lined with a finer, softer material than that used in the foundation. The chipping sparrow uses horsehair for a lining, and many birds use a very fine plant down. The crested flycatcher almost invariably puts into its nest a cast-off snake-skin.

Shape. The shape of the nest of the robin and chebec has been observed in a number of cases to be moulded by the breast of the bird, which moves round and round in the nest fitting it to the breast.

The cavities which woodpeckers make are found to agree in general shape. This cavity is not simply a hole of uniform diameter, but it is somewhat flask-

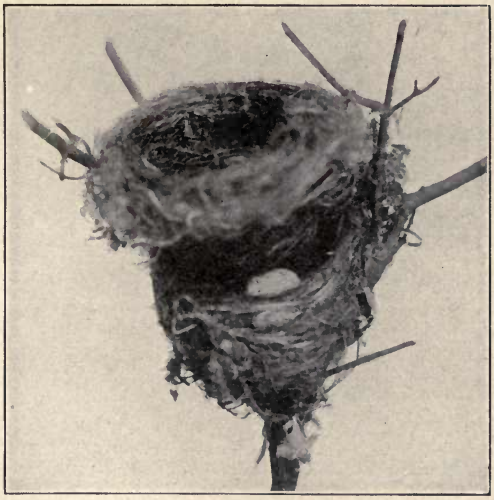
shaped, gradually growing larger till near the bottom, and then tapering to a point. The only materials in the woodpecker's nest are the chips that happen to fall down, and the pointed cavity keeps the eggs from rolling around.

The marsh wren builds a globular nest attached to the reeds of the marsh and makes an entrance at one side. So strongly developed is the nesting instinct in this bird that it builds several extra nests besides the one which it uses.

Time occupied in building. Observations have been made on birds while building nests and it is found that the time occupied in building the nest varies, both with the species of bird and with the same species at different times. A pair of house wrens was found to occupy seven days in constructing a nest. This nest contained one thousand sticks, so that about one hundred and fifty sticks were brought a day, or an average of ten per hour.

Mr. Francis H. Herrick watched a pair of robins building and found that they completed the nest in three days. On the first day the birds worked five hours; on the second, fourteen, and on the third four and one half, making a total of twenty-three and one half hours. On the first day, both male and female worked; on the second and third days, the female alone. During this time two hundred and eighteen loads of material were brought to the nest. On the first day an average of seventeen visits per

YOUNG GREEN HERONS IN NEST



TWO-STORIED NEST OF YELLOW WARBLER

Showing cowbird's egg sealed in lower nest

hour was made; on the second day, eight visits; and on the third day, five visits.

Cowbird. The cowbird never makes a nest of her own, but lays her eggs in the nests of other birds, and these eggs are usually hatched and the young reared by the foster mother. These eggs are generally laid in the nests of birds smaller than the cowbird, so that when the eggs hatch, the young cowbird gets more than its share of food and gradually either starves the other nestlings or crowds them out of the nest, so that the rearing of this parasite usually means the destruction of all the other nestlings.

There are ninety species of birds on which the cowbird has been known to impose in this way. When the young cowbird is full-grown and leaving the nest, it is a most curious sight to see the little foster mother feed her adopted baby. Once the author saw a little mother redstart, a little over five inches in length, following around and feeding a nearly full-grown cowbird nestling, about eight inches long. The little mother seemed quite as concerned over her big baby as she would have been over her own offspring.

There are a number of interesting records showing how the yellow warbler meets this difficulty. When she has found a cowbird's egg in her nest, she has been known to make another nest on top of the first, thus sealing up the intruder's egg, and then to lay her eggs and rear her young in the second story.

And when the cowbird has visited the nest again and laid her egg in this second nest, the warbler has been known to build a third nest on top of the other and there rear her young, in the third story. This action certainly strongly suggests some degree of intelligence on the part of the warbler.

Number of broods. The general rule among birds is that one brood is reared each season, but a number of common birds, such as the robin, bluebird, and wren, rear two, and perhaps occasionally three broods; and the English sparrow has been known to rear six broods in a season.

Change in nesting-habits. Many birds have changed their nesting-habits to adapt themselves to the conditions brought about by man. Chimney swifts, which formerly nested in hollow trees, now nest in chimneys. Cliff swallows now nest under eaves instead of on cliffs. The purple martin has left its nesting-sites in hollow trees and now nests almost entirely in houses provided for it. The phœbe has largely abandoned its nesting-place on the face of cliffs and now nests around sheds and barns and under bridges. Many birds which formerly nested in cavities now nest in boxes provided for them. The most common occupants of these houses are wrens, bluebirds, and martins.

CHAPTER IV

HOME LIFE OF BIRDS

The eggs. The most common colors found among birds' eggs are white and various shades of brown and blue. It seems to be a general rule that eggs which are laid in cavities, where they are not easily seen, like the woodpeckers', are white; and those which are laid in more exposed positions take on some brighter color. But there are exceptions to these generalizations. Some eggs are of a uniform color, while others are spotted or mottled. The number of eggs laid varies from one to twenty. For most of our common land-birds the number ranges from four to six.

Incubation. The period of incubation ranges from twelve days for a small bird like the chipping sparrow to twenty-eight days for a large bird like the osprey. The larger the egg, the longer the time usually required for incubation. The work of incubation is done chiefly by the female, but in some cases the male may help, or the male may feed the female on the nest. While the female is incubating the eggs, one of the chief duties of the male is to drive away any intruding birds or animals that may come within a certain distance.

Condition of young at birth. For the most part the lower forms of birds are precocial, the young being ready to walk when first hatched; the higher forms are altricial, the young being helpless and requiring the care of the parents. This constant care of the young is a sign of advancement among all animals. Probably the first birds were all precocial and some gradually evolved the altricial habit.

Time in nest. The time that the altricial birds remain in the nest varies with the size of the birds. In general the larger birds remain longer in the nest than do the smaller birds. In the case of the song sparrow, the young may leave the nest at the end of a week, while some birds may remain several months in the nest; but for most of our common birds the time averages about two weeks.

The following tables give in brief form some facts regarding the nesting-habits of a few birds. These figures represent observations made of a particular pair of birds. Observations on other birds of the same species would doubtless give different figures. But these results give at least an approximate idea of the time involved in these various activities. The incompleteness of this table suggests how many things are yet to be learned about the habits of our common birds.

The work of the parent birds in rearing their young consists chiefly in three activities: feeding the young, cleaning the nest, and brooding the young.

Name of bird	*Time taken to build nests (days)*	*Number of eggs*	*Time in laying eggs (days)*	*Period of incubation (days)*	*Time in nest (days)*
Cedar-bird...	2	4	4	10	14
Bluebird.....	7	3	3	15	19
Kingbird....		4		13	18
Kingfisher...		5			25
Nighthawk...		1			18
Baltimore oriole.....	7	5		14	14
Robin.....	3	3		14	12
Phœbe.....		5		12	14
Song sparrow.	4	5		12	7
English sparrow.....		5			7
Wood thrush.		4		12	
House wren..	7	7	7	13	17

Feeding the young. Birds eat enormous amounts of food and grow with remarkable rapidity. Observations made on young birds show that they may eat their own weight of food in a day and increase in weight fifty per cent. One observer watched a nest of cedar waxwings and weighed the young each day till they left the nest. He found that the weight of one nestling was doubled on the first day, more than trebled on the second, and nearly quadrupled on the third. By the twelfth day it had increased in weight thirteen fold, and was nearly three times as long as when first hatched.

The parents usually begin to feed the young at about sunrise and continue till sunset, making a working day of about fifteen hours. Observations

show that on the average many birds feed their young about every four minutes, or about two hundred times a day.

In order to convey some idea of the vast amount of food consumed by nestlings, a table is given below showing the number of times the young are fed hourly, during the day, as learned from actual observation. The number of visits varies with the age of nestlings, as they are generally fed oftener when nearly fledged than when first hatched.

Name of bird	*Times family fed in one hour*	*Number of nestlings*	*Age of nestling (days)*
Red-winged blackbird	10	3	10
Bluebird	13	3	5
Catbird	13	4	7
Cedar-bird	6	4	9
Rose-breasted grosbeak	40	4	Not recorded
Kingbird	23	4	12
Baltimore oriole	19	4	10
Phœbe	17	2	4
Robin	7	3	9
Song sparrow	17	4	7
Tree swallow	14	6	13
Red-eyed vireo	7	2	7
House wren	19	4	3
Average	15		

Kind of food. The kind of food fed the young is usually the same kind that the adults use, which for most birds is insects, but in the case of the seed-eating birds, like sparrows, the young are fed at first

almost exclusively on insects. The most common kinds of food are caterpillars, spiders, and grasshoppers. Some birds feed fruit to their young, the kingfishers feed fish, and hawks and owls feed mice and other rodents.

Large insects are frequently broken into smaller pieces by the parents before being fed to the young. Some birds, like the hummingbird and flicker, feed their young by regurgitation. The food is first partially digested in the crop or stomach of the parent bird and then fed to the young by the parent bird's inserting its bill far into the mouth of the nestling. As a prevention against overfeeding, young birds have an instinctive response in the throat. The parents place the food in the throat, and if the gullet is already full, the throat does not respond, and the parent removes the food and puts it into the throat of another, till one is found which does respond.

Cleaning the nest. Another duty of the parents is to keep the nest clean. The excreta of the young are voided in membranous sacs, and these are either removed by the parent or swallowed.

Brooding. During hot days birds may frequently be seen brooding their young. They stand with spreading wings and tail shielding the young from the sun's rays, often themselves panting with wide-opened bills. During hot days this may occupy a large portion of the bird's time, the bird sometimes

remaining for a period of forty minutes without leaving. In the same way the birds may protect their young from rain.

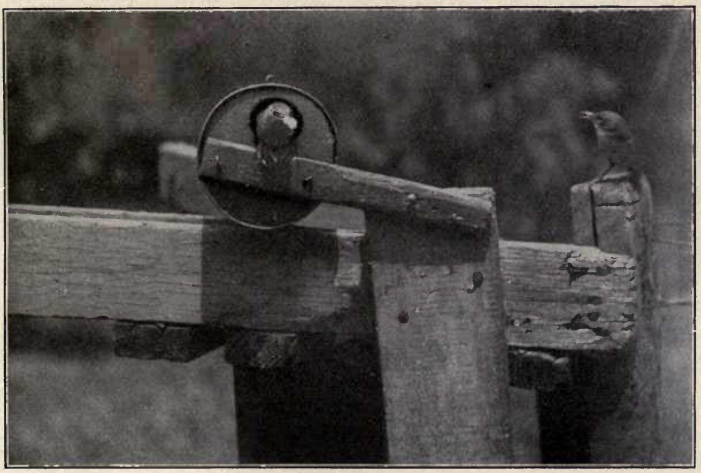
A house wren's day. In order to give some idea of the activities of birds while rearing their young, the following account of a day's observations of a pair of house wrens is given.

During the summer of 1913 the class in nature-study at the Mankato State Normal School kept a detailed record for one day of the feeding activities of a pair of house wrens which reared their young in a nesting-house located on the writer's grounds. The class was divided into ten sections and each section watched the birds for an hour and a half. The young wrens were two days old. The day was a typical, clear summer day with the temperature 67 degrees at 4 o'clock A.M. In the afternoon there was a heavy shower.

The observations began at 4 A.M., a half-hour before sunrise, and extended till 8.20 P.M., a half-hour after sunset. The birds began to feed their young at 4.36, three minutes before sunrise, and continued till 7.58, thirteen minutes after sunset, thus making a working day of fifteen hours and twenty-two minutes. At the end of the day the records were summarized with the following results: The young birds were fed two hundred and thirty-eight times, two hundred and eighteen by the female, eighteen by the male, and on two visits the sex was not deter-

UNIV. OF CALIFORNIA

A WREN MOTHER AND HER FAMILY



MOTHER WORKS WHILE FATHER SINGS

Pair of house wrens

mined. The following table shows the summary by hours:—

Hour	*By female*	*By male*	*Sex undetermined*	*Total*
4.30– 5	6	0	..	6
5 – 6	20	1	..	21
6 – 7	17	0	..	17
7 – 8	14	1	..	15
8 – 9	15	0	2	17
9 –10	19	2	..	21
10 –11	14	0	..	14
11 –12	12	1	..	13
12 – 1	17	2	..	19
1 – 2	10	1	..	11
2 – 3	17	2	..	19
3 – 4	13	4	..	17
4 – 5	16	1	..	17
5 – 6 (heavy shower)	8	0	..	8
6 – 7	10	1	..	11
7 – 8	10	2	..	12
Total	218	18	2	238
Average per hour	14	1	..	15

The longest time between any two consecutive feedings was twelve minutes, except during the shower, when a period of sixteen minutes elapsed. The shortest time between two consecutive feedings by the same parent was one half-minute. The male was singing most of the day. Frequently he sang with an insect in his closed bill, sometimes waiting several minutes before feeding the young. Three times during the day he drove away a red squirrel, and once another wren.

During the remainder of the time that the young were in the nest, they were watched occasionally

from day to day for short periods, with the following results: —

Date	Time	Age of young (days)	Number of times fed				Nest cleaned (times)
			By female	By male	Sex unknown	Total	
July 4	12– 1 P.M.	5	12	7	..	19	..
July 6	12– 1 P.M.	7	11	3	2	16	6
July 11	5– 6 P.M.	12	12	10	3	25	5
July 13	9–10 A.M.	14	10	12	..	22	6
July 13	1– 2 P.M.	14	11	10	..	21	4
July 13	4– 5 P.M.	14	8	6	2	16	4
July 13	6– 7 P.M.	14	10	10	..	20	2

On July 14 the young birds left the nest.

As shown by the above table, on July 13, when the young were fourteen days old, the birds were watched for four hours at different times of the day, showing an average of nineteen and three fourths feedings per hour. For the day of fifteen hours, this would mean three hundred and three times per day. Taking the average between this and two hundred and thirty-eight, the times the young were fed when two days old, we get two hundred and seventy times as the average number of times the young were fed daily during the period they were in the nest. Multiplying this by fifteen, the number of days the young were in the nest, gives four thousand and fifty as the total number of times the young were fed. As the parent often brought more than one insect

at a visit, the rearing of this wren family meant the destruction of from four to five thousand insects.

The largest number of times the young were fed in an hour was twenty-five, immediately after a storm when the young were twelve days old. The smallest number of times was eight during a heavy shower when the birds were two days old.

During the first days of rearing the young, most of the feeding was done by the female alone, but later more assistance was given by the male, until on the last day the work was about equally divided between them.

During the summer of 1914, a pair of Baltimore orioles was watched in a similar way for a day. The parents began to feed at 4.45 A.M., and finished at 8.45 P.M., a period of sixteen hours. Altogether the young were fed two hundred and eighty-five times, one hundred and fifty-four by the female and one hundred and thirty-one by the male, or an average of nineteen times an hour.

Devotion of parents. While caring for their young, birds show a most remarkable devotion, seldom deserting their nest, regardless of what may happen. They show reckless courage in trying to protect their young from intruders, sometimes even striking a person with their bills.

Care after leaving the nest. After the young leave the nest, they must be taught many lessons before they are able to care for themselves. One of

the first lessons learned is how to fly. The parents will often hold the food in front of the young and fly from branch to branch to induce the young to do the same. The young must also be taught where to find their own food and how to pick it up. When the young first leave the nest, they do not even know how to pick up an insect. If food is brought and placed beside them, they stand with heads thrown back and mouths wide open, expecting to be fed as they always have been while in the nest, and make no attempt to pick up the food. The parents teach the young by doing the action over and over again before them, and then leaving the young beside the food for a long time. And besides these there are many other lessons the young birds must learn.

This period of schooling is very brief, probably only a few weeks, and in the case of birds that rear two broods, the first brood is hardly properly taught before the second brood is started.

Enemies. During the time that the young are in the nest and for a short time just after leaving it, the birds are exposed to many dangers and fall victims to their many enemies. Probably only a small proportion of young birds ever reach maturity. From the time the first egg is laid, the difficulties arise. Some enemies destroy the eggs; such as the crow, blue jay, and red squirrel. And sometimes boy egg-collectors may devastate a whole neighborhood.

When the young are hatched, they are utterly helpless and fall a prey to any enemy that can reach the nest. Undoubtedly the worst enemy of nesting birds is the cat. It finds the nests on the ground and climbs to nests situated in trees, and easily catches the young birds just as they are learning to fly, and may even kill the old birds while they are defending their young. Another very destructive enemy is the squirrel, which is able to reach almost any nest. Then, too, many birds are destroyed by unfavorable weather, by hailstorms and cold rainstorms, which chill the birds and reduce the food-supply to the starvation point. Ground-nesting birds on the farm are exposed to the dangers of mowing and other farm operations. Mr. Frank M. Chapman has well said, "With such an array of adverse conditions and relentless foes, the bird which reaches maturity may be said to have escaped nine tenths of the dangers to which bird flesh is heir."

CHAPTER V

THE COLORS AND PLUMAGE OF BIRDS

Moulting of scarlet tanager. The bright colors of plumage found on some birds have been one means of attracting attention to the study of bird life. Quite as interesting as the bright colors themselves are the changes in color through which a bird may pass during a year. The case of the scarlet tanager may be taken as an illustration. When the young bird first leaves the nest, its general color is yellowish green above and streaked below. During the fall these feathers are moulted and a new set appears, the bird being olive green above and greenish yellow below, with brown wings and tail. The bird passes the winter in this plumage, that of the male and female being similar. In the spring the bird again moults and the male acquires the bright-red body feathers, while the female retains its olive-green color. These are the breeding-plumages which the birds retain during the summer. In the fall the birds moult again and the male again acquires the greenish plumage of the previous winter except that its wings and tail are now black instead of brown.

Moulting. All birds moult in the fall, and when the male in his summer plumage is more brightly

colored than the female, he takes on during the winter a duller color similar to that of the female. Some birds moult again in the spring, as in the case of the brightly colored birds just mentioned, when the male again acquires his bright breeding-plumage. Sometimes this moult is complete, sometimes only partial.

Change due to wear. A bird's color may also change by wear and fading. The tip of a feather may be of a different color from the rest of the feather, and when this tip wears off, another color will be exposed. When the male bobolink first moults in the spring, it is of a yellowish color, due to yellow tips on the feathers. In a few weeks these yellow tips wear off exposing the black and giving the bird its characteristic summer plumage. Other illustrations are found in the snow bunting and red-winged blackbird.

Changes in color. The color of an individual bird may change in accordance with two factors, age and season. The plumage of the nestling is often different in color from that which it later acquires. When the male and female are differently colored, the young usually resemble the female, as with the goldfinch and scarlet tanager. In the case of the bluebird, however, the young birds have spotted breasts and resemble neither of the adults entirely, although even here the general color is similar to that of the female. When the male and female are alike, the

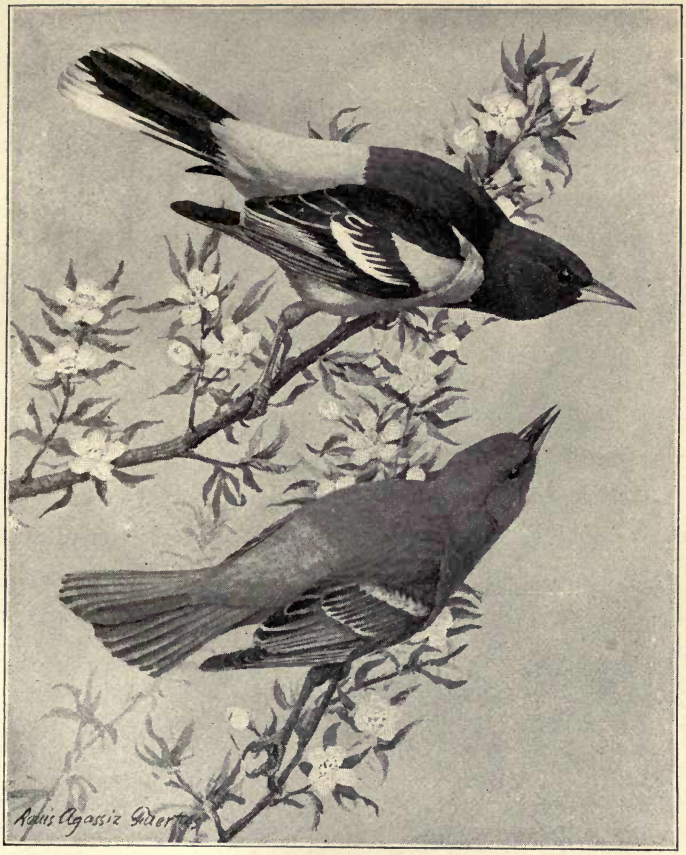
young usually resemble them, as in the case of the chickadee. But in the case of the red-headed woodpecker, the young lack the brightly colored feathers that both adults possess on the head.

The color of a bird may also change according to season. In the case of those birds in which the male and female are differently colored, the male has two distinct plumages, that of the summer, which is usually conspicuously colored, and that of the winter, which is usually dull-colored. And during the two moulting periods when the bird is changing from one plumage to another, it may show a partial combination of both plumages.

Differences in sex. Some species of birds show a difference in color between the male and the female. Sometimes this difference may be slight, as in the yellow warbler, Baltimore oriole, and bluebird, involving only different shades of the same color; or it may be extremely conspicuous, involving an entire change of color, as with the red-winged blackbird and its sparrow-like mate, the scarlet tanager and its greenish mate, the rose-breasted grosbeak and its brownish mate. Other examples are the indigo bunting, goldfinch, and bobolink.

Protective coloration. Naturalists are not agreed as to the significance of the extremely bright colors found on some birds, but it seems to be a very general law that the coloring of many birds is such as to render them inconspicuous and thus furnish pro-

UNIV. OF CALIFORNIA



BALTIMORE ORIOLE

Upper, male; lower, female

tection from their enemies; hence the term, "protective coloration." Many birds that live on the ground, such as the ruffed grouse and woodcock, are so similar in appearance to their surroundings that the birds are rendered almost invisible.

Many birds are protected by the law of counter-shading. The back which is exposed to the light, is darker than the breast, which is in the shadow, and the sides gradually shade from dark above to light below. The effect of this gradation in coloring is to make the bird so harmonize with its surroundings that it is rendered much less conspicuous than it would otherwise be. It is very common to find birds with the under parts lighter colored than the upper parts; such as the house wren, phœbe, red-eyed vireo, cuckoo, and many others. This law has been worked out and proved by means of interesting experiments by Abbott H. Thayer.

CHAPTER VI

HOW TO KNOW THE BIRDS

Attractions of bird-study. The only way really to know the birds is to study them in the field in their natural environment. Bird-study furnishes one of the most attractive hobbies. The pleasure that birds furnish in this way makes their æsthetic value quite as important as their economic value. Bird activities pass through so many changes in the course of a year that there is no opportunity for bird-study to become monotonous. Then, too, bird-study takes one out into the fields, in the open, so that the setting in which bird-study is carried on is in itself attractive. While the individuals of a species change, the species remains about the same to us, and thus we come to associate with certain birds some of our pleasantest reminiscences. People and conditions in our former homes may change, but as we return to visit these scenes of our younger days, the bird life remains unchanged to welcome us and remind us of former days.

While special trips to the woods and water to look for birds offer many pleasant hours, yet, perhaps, the greatest pleasure from bird-study comes through the observation of the birds found around one's

home, as one sits on the porch and watches the wrens and bluebirds rear their young in the houses provided for them, or sees the robins and flickers that dot the lawn in search of insects, or hears the bird chorus that swells through the open window as one awakens in the early spring morn. The pleasure thus derived is the lasting, unconscious enjoyment that becomes an intimate part of one's life.

Birds also appeal to the imagination on account of the annual cycle of life changes through which they pass over and over again year after year. It seems as though every spring birds were reborn and lived their lives over again, so that youth seems forever renewed with the return of the first birds.

There are all stages of attainment possible to suit every condition, from the identifying of a few birds in the field up to the most careful study of bird habits, which may occupy one's entire time. One of the most satisfactory methods of studying bird life is to observe close at hand in one's yard the birds that may be attracted there by nesting-houses, fountains, and food. This will be discussed more fully in the chapters on attracting birds.

Identification. The first step in bird-study is the identification of birds. Learning a bird's name is much like an introduction to a person; it is a means by which a new friendship may be formed. But there is a great deal of pleasure in merely learning to name the birds. Many people will never care to go beyond

this point in bird-study. The ability to name the birds from year to year as they return in the spring is one of the chief pleasures in bird-study, and gives a sort of feeling of friendship for the birds. But in the process of learning the names of birds, one of necessity learns many interesting things about them. There is a sort of fascination to see if one can learn to name all the birds of a locality. It serves as an incentive from year to year, as one recognizes the old friends, to try each year to make a few new friends, as well as to get better acquainted with the old.

Equipment. In order to name the birds, the first essential is a bird book. There is a great variety of books on the market adapted to every requirement. For the purpose of identification the most helpful books are those that contain colored pictures. For a beginner in bird-study, who knows only a few birds, Reed's "Land Birds" is well adapted. This contains a small colored picture of every land bird in the eastern United States, accompanied by a brief description of the bird. This is a small book and can easily be carried in the field. Mr. Reed has a companion volume entitled "Water Birds," on the same general plan. These books cost from seventy-five cents to one dollar and a quarter, according to the binding.

After one has made a beginning and can name twenty-five or thirty birds, an excellent book for general reference is Chapman's "Handbook of Birds

TOWHEE, OR CHEWINK

Upper, male; lower, female

of Eastern North America." This contains a detailed description of all the birds of eastern North America, and about one hundred pages of reading matter about bird habits. This costs three dollars and a half. Another helpful book for identification is Ralph Hoffmann's "Guide to the Birds of New England and Eastern New York."

Provided with these books one may hope to name most of the common birds. These and other bird books may be obtained through bookstores or through the National Association of Audubon Societies, 1974 Broadway, New York City.

If one has access to a museum with a collection of birds, the study of the specimens there will be a great help in identifying the birds found in the field, but pictures may serve as a satisfactory substitute. Separate colored plates of birds may be obtained of the Association of Audubon Societies, just mentioned, at two cents each. The pictures of about ninety birds have been issued so far and new ones are being made each year.

A pair of opera- or field-glasses is a wonderful help to bird-study. Some birds are easily frightened, and often it is not possible to approach near enough to see them distinctly without glasses. Many of our common birds have become accustomed to man and allow one to approach them closely, but glasses add much pleasure to bird-study and render it much more effective and satisfactory. A very good glass,

magnifying three diameters, may be obtained for six dollars from the National Association of Audubon Societies.

Points to observe. Color is the best aid in the identification of birds in the field. When a new bird is seen, a record should be made at the time, in a notebook provided for the purpose, of the color markings and their location, whether on head, back, tail, wings, or breast. The size should be noted in comparison with some well-known bird, like the robin or English sparrow. The shape of the bill is also a help in identification. Shapes of wings and peculiarities in method of flight should be noted. Some birds are on the wing almost constantly.

Some birds have white lateral tail feathers, which show only in flight, and these make good field marks for identification. These are found on the vesper sparrow, junco, meadowlark, and towhee.

Some birds are usually found on tree-trunks; as the woodpeckers, the nuthatch, and the brown creeper. The nuthatch can be told by its method of hopping down the tree-trunk head first.

One of the best ways of identifying birds is through their songs. Birds can thus be identified at a long distance and when hidden in the foliage of trees and shrubs. It is difficult to make a record of these songs that will help any one else, but some record made at the time may help the one making it in identifying the bird later.

Many birds have one or two conspicuous field marks by which they may be identified. So that it is not necessary to make a detailed description of every part of all birds seen, as one soon comes to learn these conspicuous markings and to name the birds from them.

Where to find birds. The best place to begin the study of birds is right around one's own home, if this be situated in the country or a small town, or on the edge of a city. Many birds prefer to live around human habitations if the houses are not too thickly crowded together. If measures are taken to attract birds and if they are protected from their enemies, the number of birds found around one's home may be increased. The birds found here one may enjoy at all times without undertaking any special bird trips. If one lives in a city, the parks are good places in which to study birds, especially during the spring migration. In the Boston Public Garden, one hundred and ten species have been reported in nine years; in Lincoln Park, Chicago, one hundred and fourteen species have been seen; and in Central Park, New York City, one hundred and forty species have been recorded. In a little book by Herbert E. and Alice H. Walter, entitled "Wild Birds in City Parks," the authors write in their preface:—

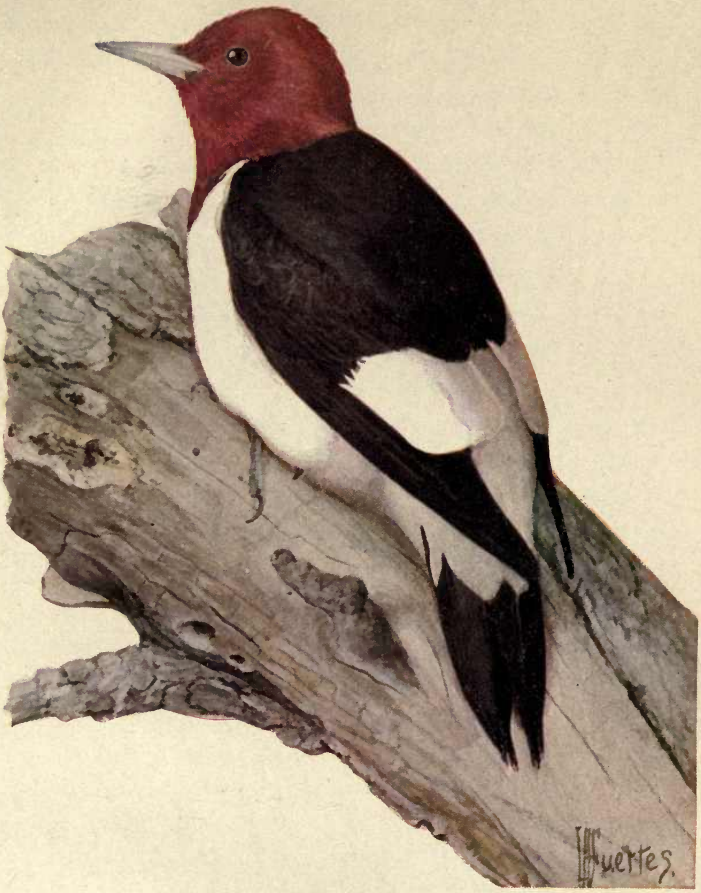
Any one caring to make use of these hints may be assured that during the migrations of the birds, city dwellers have one of the keenest delights of country life

brought to their very doors, because many birds, migrating largely at night, are attracted by the lights of the city and stop off in their long journey to feed, so that a city park often contains a greater variety of feathered visitors than an equal area in the country.

One will see a greater variety of birds if he visits a number of different localities. Some birds have certain habitats where they are chiefly found. In the swamps are found water-birds, which are not often found elsewhere. In the woods one is more apt to see the vireos, warblers, and some of the thrushes. In the meadows are found the bobolinks and some of the sparrows. The orchard is a locality where a great variety of birds may be found.

When to find birds. A good time to begin the study of birds is in the late winter or early spring. The number of birds seen at this time is comparatively small, and it is not so confusing to the beginner as it is later when the birds are numerous. By starting at this time one may learn a few birds at a time and keep increasing the number as the later migrants arrive. Another advantage in beginning at this time is that the birds can easily be seen, because there is no foliage to conceal them. Later in the season, when the leaves have developed, it is much more difficult to see them.

The spring is the most interesting season to study birds. It is the season of bird song and of nesting, and birds render themselves very conspicuous at



RED-HEADED WOODPECKER

this time. Later, when home duties begin, there is less singing and birds are more wary about exposing themselves. June, when the nesting-season is at its height, is also an interesting month for bird-study. During the late summer, birds are moulting, and remain quiet and concealed, so that it is a discouraging season for bird-study. Then during the fall follows a more active period when the fall migration is under way. During the winter there is opportunity to study at close hand the winter birds that may be attracted by food.

The best time of the day to study birds is in the early morning up to about nine o'clock, as this is the time when birds are most active and do most of their singing. The next best time is in the late afternoon.

How to study birds. In order that one may be most successful in finding birds, a few precautions need to be observed. Loud noises should be avoided, as should quick, sudden movements. It is well sometimes to seat one's self in one place and remain quiet for some time, to find the birds that may be seen in that one locality. Birds may be attracted by making a sort of squeak, which is made by kissing the back of the hand vigorously. This will often bring out birds whose presence had not been suspected.

Every season of the year has something new in the line of bird activities, so that there is a constant

variety of interesting things to attract one's attention.

What to study. Beginning in the early springtime and continuing till the last of May, one may keep a record of the spring migration. In its simplest form this may consist of two columns giving the name of the bird and the date when first seen. To this may be added as many more points as one wishes, such as place where seen, number, etc. These records may be kept in the following tabular form: —

Name of bird	*Date when first seen*	*Place where seen*	*Number seen*

It is interesting to spend all of a day or a part of a day during May in the field, to see how many birds one can find in a day. This is the season when one can find the greatest number in the northern United States, as it may include permanent and summer residents and transient visitants.

Songs. Shortly after birds arrive in the spring, they are in full song, and this bird music forms one of the most attractive features for study. Some of the things that may be noted are the time of day when the song is given, length of singing-season, character of song, its variety, pitch, quality, location of bird when given, and whether given on the wing. Some brief description of the song written in a notebook

will help fix it more firmly in the mind. Any of the methods described in Chapter II may be used, or simply a description in words may be given. Another interesting study is to begin just before sunrise some morning in May, and note the order in which the different birds begin to sing, and the order in which they leave off as the day progresses. Likewise the order of beginning and stopping in the late afternoon.

Nesting-habits. The nesting-season offers opportunity for the closest observation of birds. Many things may be learned which have never before been recorded. Some things that may be observed are the location of the nest, materials used in making it, work done by male and female, length of time required to build, number and color of eggs, time of incubation, number of times young are fed in an hour, kind of food brought, how the work is divided between male and female, time young remain in nest, care of young after leaving nest.

During the height of the nesting-season, about the middle of June, a list may be made of all the birds seen for a week, which will include those birds that nest in a locality, as by this time the transient visitants have departed.

The United States Bureau of Biological Survey has begun to have annual censuses taken by volunteer bird-students throughout the United States, so that some definite information may be obtained re-

garding the number of birds and the need for their protection and increase. Details of how this census is to be made may be obtained by writing to the Bureau of Biological Survey, Washington, D.C.

Winter birds. During the winter, birds may be attracted around the home by means of food placed on trees and shelves and even on the window-sill, and thus an opportunity offered to study birds through the window even in the coldest weather. Different kinds of food may be tried to see which each bird likes best and which foods birds will eat. The habits of the birds in approaching the food and in eating it are interesting to watch.

Christmas census. It has been the custom of "Bird-Lore" to invite its readers to make a bird census on Christmas Day and to send the list of birds seen to "Bird-Lore." These lists are published in the next issue of the magazine. Below is a sample record taken from the January–February issue, 1915: —

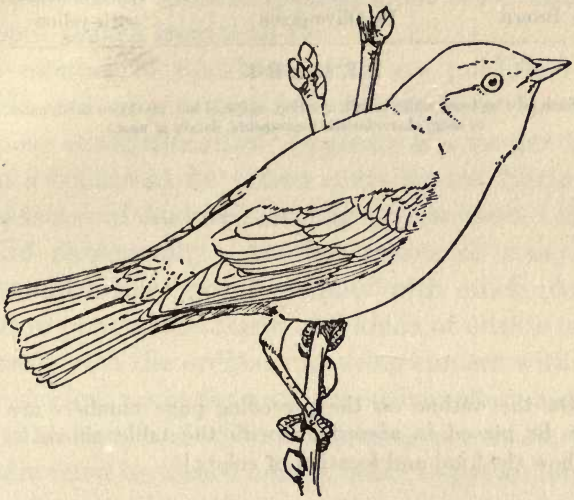
Eagle Bend, Minn. — Dec. 24; 10 A.M. to 4 P.M. Clear; about 3 in. of snow; no wind; temp. −5°. Bob-white, 12; Ruffed Grouse, 4; Pileated Woodpecker, 2; Hairy Woodpecker, 4; Downy Woodpecker, 3; Evening Grosbeak, 10; White-breasted Nuthatch, 2; Black-capped Chickadee, 11. Total, 8 species, 48 individuals.

In the census for 1914 the greatest number of birds was reported from Santa Barbara, California; 108 species, 7269 individuals; the smallest number

Location _____

Date _____ Hour _____

Weather _____ Wind _____



SIZE:		Between sparrow and robin
Smaller than wren		Between robin and crow
Between wren and sparrow		Larger than crow
SEEN:	Bushy places	Swamp
Near ground or High up	Orchard	Open country
In Heavy woods	Garden	Near water

Name _____

Order _____ Family _____

Genus _____ Species _____

COLORS:

1 Black	6 Chestnut	11 Gray
2 White	7 Yellow	12 Slate
3 Blue	8 Orange	13 Rusty
4 Red	9 Green	14 White washed with yellow
5 Brown	10 Olive green	

REMARKS:

(Such as wing bars, white in tail, eye ring, shape of bill, marks on head, notes or song, characteristic movements, details of nest.)

[On the outline on the preceding page numbers are to be placed in accordance with the table above to show the kind and location of colors.]

from Buffalo, New York, 4 species, 8 individuals. In the northern part of the United States the number was smaller than in the southern part. The average number of species reported from the northern sections ranged from 7 to 15.

A number of bird notebooks are published in which one may record his observations, for the purpose of identification. Opposite is a sample leaf from a book sold for fifteen cents by the National Association of Audubon Societies, New York City.

Bird photography. Another means of studying birds which some people employ with much pleasure is to photograph them. All kinds of outfits may be used, from the ordinary focusing camera with an ordinary lens up to the most expensive reflex camera with the best kind of lens. As birds are small, the camera must be placed near in order to get an image of sufficient size, and hence the camera must be provided with a long draw of bellows and a long-focus lens.

In order that the birds may come near enough to the camera so that a satisfactory picture may be secured, it is usually necessary to work the shutter from a distance. One of the simplest methods is to use a spool of linen thread. The thread is fastened to the shutter and then this may be worked by pulling the thread from any desired distance. Sometimes birds will become so tame that one may stand by the camera and take pictures, as when photographing

from inside the window birds feeding on a window-sill.

The two best seasons for photographing birds are the spring and summer, when the birds are nesting, and the winter, when they come to eat food provided for them. If one attracts birds around his home, he will find many opportunities for photographing them. The birds that use nesting-boxes become tame and may easily be photographed after the young are hatched, as the parents enter and leave the box. One may watch the birds to see how they approach and where they usually alight, and then the camera may be focused on this spot, and when the bird is in the right position, the thread may be pulled.

Likewise, the winter birds become very tame, coming to the window shelf for food, and the camera may be set up just inside the window and the picture taken through the window-pane. A little patience will often enable one to secure a picture of a bird feeding from the hand. During one winter the author was able to secure pictures of the nine following species: chickadee, white-breasted nuthatch, downy woodpecker, brown creeper, blue jay, hermit thrush, myrtle warbler, junco, and song sparrow. Pictures of all except the junco were obtained at the window-sill. Pictures of the chickadee feeding from the hand were secured.

Besides these pictures of birds that nest in boxes

there will be many opportunities of photographing the nests and eggs of other birds and the parents feeding their young.

Many people are now using the camera instead of the gun, and it is found that the use of the camera requires much more skill and patience than the use of the gun, and gives one more pleasure and does no harm to the birds. For this kind of hunting there is no closed season.

As a matter of convenience for reference, the following table of fifty common birds is given, showing the dates of migration and nesting for the vicinity of New York City as found in Chapman's "Handbook of Birds." These dates are earlier for regions farther south and later for those farther north: —

CHART OF FIFTY COMMON BIRDS

(Latitude of New York City)

Permanent Residents

Name	*Date of nesting*
Bob-white	May, 4th week
Chickadee	May, 3d week
Crow	April, 2d week
Goldfinch	June, 3d week
Blue jay	May, 2d week
White-breasted nuthatch	April, 3d week
Downy woodpecker	May, 3d week

Winter Residents

Name	*Date of arrival*	*Date of departure*
Brown creeper	Sept. 20–30	April 1–30
Junco	Sept. 20–30	April 10–May 10
White-throated sparrow	Sept. 20–30	May 1–25
Tree sparrow	Oct. 20–31	April 1–30

Summer Residents

(Arranged in the order of their arrival in spring)

Name	*Date of arrival*	*Date of nesting*	*Date of departure*
Song sparrow	Feb. 15–March 10	April, 4th week	Nov. 1–30
Flicker	Feb. 15–March 10	May, 1st week	Nov. 1–30
Crow blackbird	Feb. 15–March 10	April, 4th week	Nov. 1–30
Red-winged blackbird	Feb. 15–March 10	May, 3d week	Nov. 1–30
Robin	Feb. 15–March 10	April, 3d week	Nov. 1–30
Bluebird	Feb. 15–March 10	April, 2d week	Nov. 1–30
Phœbe	March 10–20	April, 4th week	Oct. 20–30
Meadowlark	March 10–20	May, 3d week	Nov. 1–30
Cowbird	March 10–20	May, 1st week (In other nests)	Nov. 1–30
Kingfisher	March 20–31	May, 1st week	Nov. 1–30
Mourning dove	March 20–31	April, 4th week	Nov. 1–30
Vesper sparrow	April 1–10	May, 2d week	Nov. 1–30
Chipping sparrow	April 1–10	May, 2d week	Nov. 1–30
Barn swallow	April 10–20	May, 2d week	Oct. 1–10
Chimney swift	April 20–30	May, 4th week	Oct. 1–10
Towhee	April 20–30	May, 2d week	Oct. 20–30
Purple martin	April 20–30	May, 4th week	Sept. 20–30
Oven-bird	April 20–30	May, 3d week	Oct. 1–10
House wren	April 20–30	May, 3d week	Oct. 10–20
Brown thrasher	April 20–30	May, 3d week	Oct. 10–20
Catbird	April 20–30	May, 3d week	Oct. 10–20
Wood thrush	April 20–30	May, 3d week	Oct. 1–10
Cuckoo	May 1–10	May, 4th week	Oct. 1–10
Nighthawk	May 1–10	June, 1st week	Oct. 10–20
Hummingbird	May 1–10	May, 2d week	Sept. 20–30
Kingbird	May 1–10	May, 4th week	Sept. 20–30
Baltimore oriole	May 1–10	May, 4th week	Sept. 10–20
Bobolink	May 1–10	May, 4th week	Oct. 1–10
Indigo bunting	May 1–10	May, 4th week	Oct. 1–10
Rose-breasted grosbeak	May 1–10	May, 3d week	Sept. 20–30
Scarlet tanager	May 1–10	June, 1st week	Oct. 1–10
Red-eyed vireo	May 1–10	May, 4th week	Oct. 10–20
Warbling vireo	May 1–10	May, 4th week	Sept. 20–30
Yellow warbler	May 1–10	May, 3d week	Sept. 10–20
Maryland yellowthroat	May 1–10	May, 4th week	Oct. 10–20
Redstart	May 1–10	May, 3d week	Oct. 1–10
Veery	May 1–10	May, 3d week	Sept. 20–30
Wood pewee	May 10–20	June, 1st week	Sept. 20–30
Marsh wren	May 10–20	May, 4th week	Oct. 10–20

CHAPTER VII

FRIENDS AMONG THE BIRDS AS DESTROYERS OF INSECT PESTS

THE practical value of birds to man, whether helpful or harmful, depends chiefly on their food habits. Some of their food consists of things injurious to man, such as insect pests, weed seeds, and rodent pests, while some consists of things valuable to man, such as fruit and grain: so that the exact economic status of a bird is determined by a careful study of its food habits.

The United States Bureau of Biological Survey. The first systematic and thorough study of the food habits of birds began in 1885, when the National Government established a section of economic ornithology whose purpose was to investigate the food habits, distribution, and migration of North American birds and mammals in relation to agriculture, horticulture, and forestry. This was later given the title of Bureau of Biological Survey. Its work upon the economic value of birds has been along three lines: (1) to determine as accurately as possible the food of birds of economic importance; (2) to act as a court of appeal to investigate complaints concerning depredations of birds on crops; (3) to diffuse

the results of its work and to educate the public as to the value of birds.

Since its formation, the Bureau has collected a large mass of facts regarding the food habits of over four hundred species of birds and has published the results of its investigations in bulletins printed by the Government, some given away, others sold at nominal prices. Some conception of the work of the Bureau may be gained by looking over the partial list of bulletins given on pages 318–19. This work has steadily grown in importance and to-day the Bureau is one of the most serviceable divisions of the Department of Agriculture, employing eleven men in the work on economic ornithology.

Methods of determining food of birds. Three methods have been used to determine the food habits of birds: (1) field observations of living birds to observe the kinds of foods taken and the amounts; (2) study of birds kept in captivity; (3) examination of the contents of birds' stomachs after the birds have been killed.

Field observations. In order to determine a bird's food from a study of the living bird, it is necessary to get close to the bird or use a pair of field-glasses, and even then it is difficult to determine exactly the specific nature of the food. This method can best be used in studying the food of nestlings. The parents bring food frequently to the same spot and one is able to approach close to the nest. Some observers

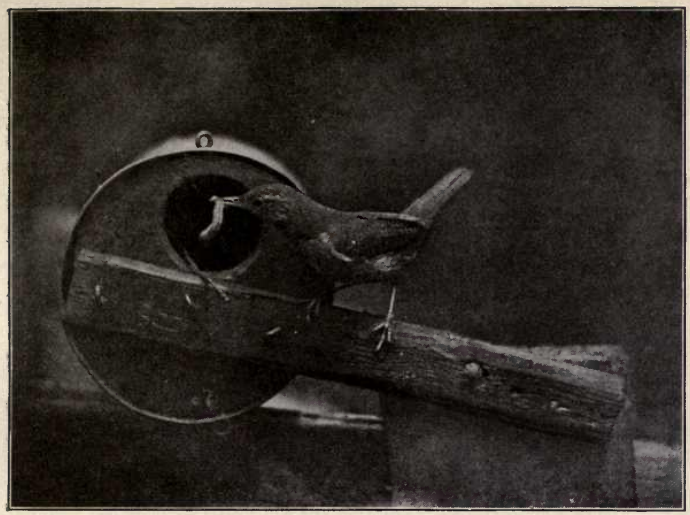
place a small tent within arm's length of the nest and watch the bird from within the tent. The birds usually become accustomed to the presence of the tent and come and go as usual. The number of times that the young are fed may thus be learned. The young may be weighed each day, and thus some idea obtained of the increase in weight and of the amount of food eaten.

Birds in captivity. When birds are kept in captivity the exact amount and kinds of food eaten may be determined. The kinds eaten, under those conditions, however, are not a safe guide for determining the kinds eaten in nature, as doubtless, when hungry, birds will eat many things which they do not normally eat when at liberty. More accurate estimates may be made of the amount of food eaten, as the bird would doubtless require more food when free than when in captivity, so that the amount eaten in captivity would be a minimum.

Bob-white. The food habits of the bob-white have been studied with birds kept in captivity. Each of the following is a single day's rations: 1350 flies, 5000 aphids, 1532 insects, 600 seeds of burdock, 12,000 seeds of pigweed, 15,000 seeds of lamb's-quarters. The bob-white was found to eat in captivity 61 kinds of weed seeds, besides the 68 kinds previously recorded, making a total of 129 species. It has also been found to eat 135 different kinds of insects. As a result of these studies it is estimated

that a single bob-white will eat in a year an average of 75,000 insects and 5,000,000 weed seeds, which would make about 7½ pounds of insects and 10 pounds of weed seeds.

Examination of stomachs. But the most important method of determining the food of birds is by examination of the contents of birds' stomachs. This is the final court of appeal, and is the method used chiefly by the Bureau of Biological Survey. Many specimens of a certain bird are collected during different months from different sections of the country and sent to Washington, where the stomachs are examined. There usually remain in the stomach some of the harder portions of the insects which have not been changed, such as mandibles, scales of moths, wing-covers, and pieces of legs. From an examination of these with microscopes, experts are able to determine the insects from which they have come. Among the vegetable foods, differences in the epidermis of many fruits and in the starch grains of common cereals can be detected, and weed seeds can be identified. Food of similar kinds is arranged in piles and the percentage of the various kinds of food computed. As an illustration of the method pursued, we may take results obtained from the study of the robin. Twelve hundred and thirty-six stomachs, collected from forty-two States, the District of Columbia, and three Canadian Provinces, and representing every month in the year, were exam-



A USEFUL CITIZEN

House Wren

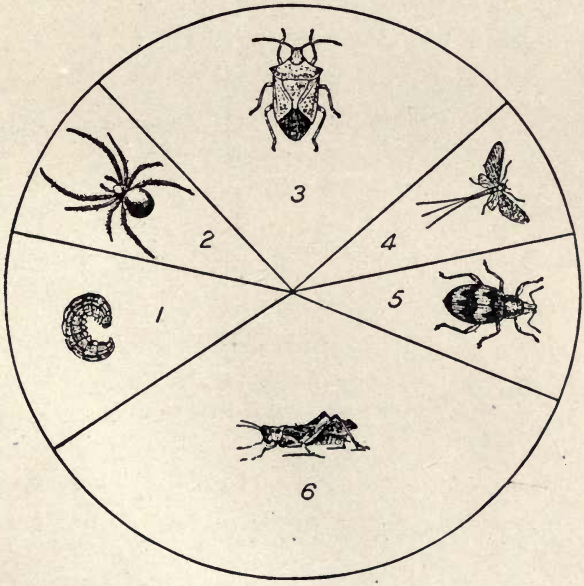


DIAGRAM SHOWING PROPORTIONS OF THE FOOD OF ADULT HOUSE WREN

1, cutworm; 2, spider; 3, stink-bug; 4, May-fly; 5, weevil; 6, grasshopper

ined. The food consisted of 42.4 per cent animal food and 57.6 per cent vegetable food, divided as follows: —

Animal food	*Per cent*
Beetles	17
Caterpillars	9
Grasshoppers	5
Flies	3
Bees and ants	3
Bugs	2
Miscellaneous	3½
Total	42½

Vegetable food	*Per cent*
Wild fruit	42
Cultivated fruit	8
Miscellaneous	7½
Total	—
	57½

The animal food included 223 kinds of insects, and the vegetable food 65 kinds of wild and 10 kinds of cultivated fruit. This food may be classified according to its value to man in the following groups:

To the robin's credit	*Per cent*	*To the robin's discredit*	*Per cent*	*Neutral food*	*Per cent*
Caterpillars	9	Cultivated fruit	8	Wild fruit	42
May beetles	5.5	Beneficial beetles	5	Miscellaneous	10
Grasshoppers	5	Spiders	1		
Weevils	4	Bees	1		
March flies	3				
Ants	1.5				
Other insects	5				
Total	33		15		52

Approximately one seventh of the robin's food is composed of materials beneficial to man, one third is composed of insects harmful to man, and about one half is composed of neutral elements.

So far more than sixty thousand stomachs, comprising over four hundred species of birds have been examined by the Bureau of Biological Survey.

Still a fourth method is the combination of field and laboratory work. The birds are studied in the field in those localities where birds are collected for stomach examinations. Facts are gathered relative to the available food-supply for birds; these, in connection with the examination of the stomach, show what a bird will eat, what it prefers, and what it refuses.

Good done by birds. These studies of the food of birds show that they help man in three ways: (1) by eating injurious insects; (2) by eating weed seeds; and (3) by eating mice and other rodents. Another way of minor importance in which the birds are useful is in acting as scavengers.

Harm done by insects. Among insects are found some of man's most common foes. In almost every walk of life, man has to contend with insects. The mosquito and fly carry diseases and thus cause thousands of cases of sickness and death every year. The gardener, the fruit-grower, and the farmer are constantly fighting the insects that prey upon their crops. In the vegetable garden, the cabbage-worm attacks the cabbage; the cucumber-beetle, the vine crops; the potato-beetle, the potatoes. In the fruit-garden, the codling moth damages the apple; the currant-worm, the currant; the white grub, the strawberry. On the farm the army-worm destroys the wheat, and the root-aphis attacks the corn. The elm-beetle and tussock-moth attack shade-trees,

and the forest tent-caterpillar destroys forest-trees. Nearly all crops have a great variety of different kinds of insects that may prey upon them. One hundred and seventy-six kinds have been found preying on the apple tree alone and four hundred kinds on the oak.

The following table prepared by the United States Bureau of Entomology gives an estimate of the annual loss caused by insects in the United States: —

Product	*Value*	*Percentage of loss*	*Value — amount of loss*
Cereals	$2,000,000,000	10	$200,000,000
Hay	530,000,000	10	53,000,000
Cotton	600,000,000	10	60,000,000
Tobacco	53,000,000	10	5,300,000
Truck crops	265,000,000	20	53,000,000
Sugar	50,000,000	10	5,000,000
Fruits	135,000,000	20	27,000,000
Farm forests	110,000,000	10	11,000,000
Miscellaneous crops	58,000,000	10	5,800,000
Animal products	1,750,000,000	10	175,000,000
Total	$5,551,000,000	..	$595,100,000
Natural forests and forest products	..	..	100,000,000
Products in storage	..	..	100,000,000
Grand total	..	..	$795,100,000

Besides the tremendous loss caused directly by the insects in destroying the crops, man spends annually millions of dollars for spraying outfits and

other means of controlling these pests. If to this be added the loss in sickness and death caused by mosquitoes and flies, the total annual toll that insects collect from man in the United States is about one billion dollars.

Power of reproduction of insects. Insects exist in enormous numbers and have a most remarkable power of increase. It is estimated that if the hop-vine aphis should multiply unchecked and each insect should live and find enough food, at the end of one season the number of the last brood would be 10,000,000,000,000,000,000,000. Dr. Hodge has estimated for the mosquito that if each insect should live, and the female lay the average number of eggs, the number of descendants of a single mosquito at the end of six months would be represented by the figure 2, followed by 39 ciphers. Of course this can never happen, on account of abundance of its enemies and lack of food.

Amount of food eaten by insects. Another fact that makes insects so destructive is the enormous amount of food they devour in a short time. Many caterpillars eat each day twice their own weight of leaves. Sometimes a single day's work of an army of insects may be enough to destroy a crop.

Nature's check on insects. The wonderful power of reproduction possessed by insects and the enormous amounts of food eaten suggest how important it is that there should be checks constantly at work

to keep down their numbers. Such a constant check are the birds, which constitute one of Nature's most effective means of controlling insects and keeping a proper balance. Parasitic and predaceous insects are another means of keeping the balance. The birds work from sunrise till sunset devouring insects during the warmer months of the year when insects are abundant, and some birds during the winter feed on insects' eggs and on the hibernating insects.

Man's disturbance of Nature's balance. Nature when left to herself has balanced these forces evenly, so that the insects are kept by birds and other natural checks from becoming excessively numerous and destructive. But man has upset Nature's balance in many ways. First, new crops have been introduced; second, forests have been cleared and crops raised on larger areas, thus furnishing more food for insects and allowing them to increase; third, many insects have unwittingly been introduced into the United States from other countries; and fourth, most strange and unbelievable of all, man has wantonly destroyed the birds, Nature's check on the increase of injurious insects.

Service performed by the birds. The great service that birds and other insect-enemies are now rendering to man is in destroying enough insects so that the remainder will not do excessive and uncontrollable damage. The birds can never utterly destroy any

kind of insect, and this might prove undesirable even if possible, but they help to keep them in check to such an extent that man is able to cope with those that are left and thus raise his crops successfully. If man were suddenly deprived of the services of the birds, this would allow insects to increase to such an extent that it would render it many times more difficult to raise crops; and some bird-students say that without the aid of birds it would not be possible to raise crops at all on account of the enormous number of insects that would prey upon them.

How serious the results would be if we were deprived of the service of the birds, it is difficult to say exactly, but enough is known regarding the balance that Nature has established between birds and insects, so that we are sure that the birds are among man's greatest friends in his warfare on injurious insects.

Amount of food eaten by birds. One thing about birds that makes them such effective checks on insects is the enormous amount of food they require. The temperature of their blood is between 102 and 112 degrees, from 4 to 14 degrees higher than that in man, and large amounts of food must be eaten to maintain this high temperature. The blood courses through the vessels with great rapidity, driven by the heart, which beats one hundred and twenty times a minute when the bird is at rest, and faster

when the bird is in motion. And the digestive system is so constructed that it digests very rapidly the bird's food, which is then taken by the blood to the various parts of the body, where its oxidation maintains the high temperature of the body. Probably the whole process of digestion and assimilation of food may take place in an hour and a half, so that during the day the bird may eat enough food to fill its stomach ten or twelve times. The study of birds in the field and the examination of the contents of birds' stomachs show that a bird devours enormous quantities of food.

Records of field observations of birds are condensed in the following table. These are taken from the reports of Edward H. Forbush: —

Name of bird	*Number of insects eaten per minute*	*Kind of insect*
Redstart	2	Brown-tail larvæ
Nashville warbler	3	Tent-caterpillars
Chickadee	4	Brown-tail larvæ
Red-eyed vireo	5	Brown-tail larvæ
Robin	7	Brown-tail larvæ
Yellow warbler	9	Caterpillars of gypsy moth
Cuckoo	14	Canker-worms
Scarlet tanager	35	Caterpillars of gypsy moth
Maryland yellow-throat	89	Plant-lice

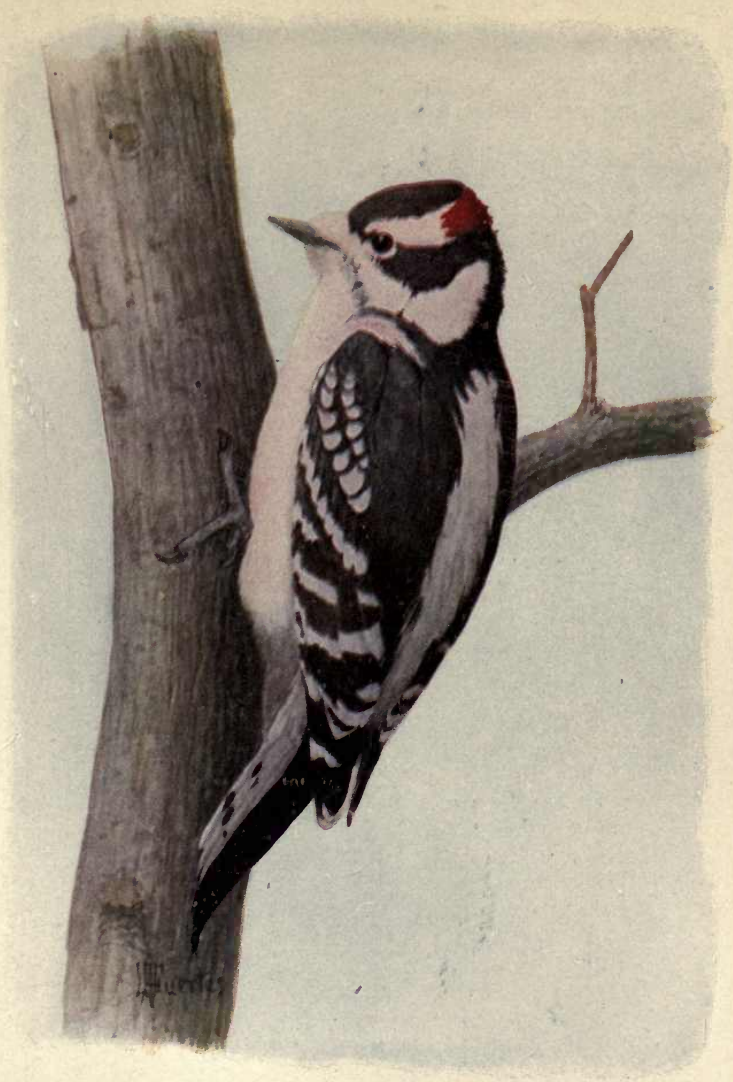
A few examples of the number of insects found in the stomach of a single bird are given below in the table. These figures are taken from the reports of the Bureau of Biological Survey: —

Name of bird	*Number of insects*	*Kind of insect*
Rose-breasted grosbeak	14	Potato-beetles (adult and larvæ)
Downy woodpecker....	18	Larvæ of codling moth
Red-winged blackbird..	28	Cutworms
Crow blackbird.....	30	Grasshoppers
Hairy woodpecker.....	100	Wood-boring grubs
Cuckoo.....	250	Tent-caterpillars
Robin.....	270	Larvæ of March-flies
Franklin gull.....	340	Grasshoppers
Flicker.....	5000	Ants

The following table showing the number of different kinds of insects eaten by various birds is based on the reports of the Bureau of Biological Survey: —

Name of bird	*Number of kinds of insects eaten*
Hairy woodpecker	21
Downy woodpecker	43
Horned lark	60
Crow blackbird	63
Cuckoo	65
Rose-breasted grosbeak	67
Red-headed woodpecker	75
Least flycatcher	75
Cardinal	81
Crested flycatcher	85
Flicker	89
Phœbe	121
Wood pewee	131
Bob-white	135
Bluebird	166
Robin	223
Kingbird	229
Nighthawk	600

The number of birds known to feed upon certain injurious insects is given in the table below. This,



DOWNY WOODPECKER

also, is based on the reports of the Bureau of Biological Survey: —

Injurious insect	*Number of species of birds feeding on it*
Plum curculio	7
Grain aphids	9
Potato-beetle	26
Codling moth	36
Birch plant-lice	38
Brown-tail moth	39
Alfalfa weevil	45
Gypsy moth	46
Scale insects	57
Boll weevil	66

Below are given some estimates that have been made of the number of insects destroyed by birds: —

Professor E. D. Sanderson estimates that the chickadees in the State of Michigan destroy annually about 8,000,000,000 insects.

In the States of Virginia and North Carolina it is estimated that the bob-white alone eats 340 tons of insects from June 1 to August 1.

Mr. Chester A. Reed estimated that in the State of Massachusetts the birds devour 21,000 bushels of insects each day during the summer season.

Mr. Bruner gives the following estimate of the number of insects destroyed in the State of Nebraska: —

Allowing 25 insects per day as an average diet for each individual bird, and estimating that we have about one and one half birds to the acre, or in round numbers 75,000,000 birds in Nebraska, there would be required 1,875,000,000 insects for each day's rations. Again, es-

timating the number of insects required to fill a bushel at 120,000, it would take 15,625 bushels of insects to feed our birds for a single day, or 937,500 bushels for 60 days, or 2,343,750 bushels for 150 days.

Another Nebraska naturalist has estimated that the birds of that State eat 170 carloads of insects per day.

It has been calculated that the birds of New York State destroy more than 3,000,000 bushels of noxious insects each season.

Value of nestling birds. Special attention may be called to the great service performed by birds when feeding their young. As explained in a previous chapter, nestlings require large amounts of food, being fed every few minutes from sunrise to sunset. This destruction of insects comes at a most opportune time, when the insects are present in great numbers and before the parasitic insects can be depended upon to reduce the pests. The chief food of the nestlings is insects. Even when the adults feed also on seeds, the young at first are fed largely on insects. The most common kinds of food of nestlings are caterpillars, grasshoppers, and spiders. A suggestive estimate of the money value of nestlings has been made in a government publication, from which the following is taken: —

During the outbreak of Rocky Mountain locusts in Nebraska, in 1874–77, Professor Samuel Aughey saw a long-billed marsh wren carry 30 locusts to her young in an

hour. At this rate, for seven hours a day, a brood would consume 210 locusts per day, and the passerine birds of the eastern half of Nebraska, allowing only 20 broods to the square mile, would destroy daily 162,771,000 of the pests. The average locust weighs about 15 grains, and is capable each day of consuming its own weight of standing forage crops, corn and wheat. The locusts eaten by the nestlings would therefore be able to destroy in one day 174.397 tons of crops, which at $10 per ton would be worth $1743.97. This case may serve as an illustration of the vast good that is done every year by the destruction of insect pests fed to nestling birds.

Number of insects destroyed by birds in the eastern United States. Birds feed their young, on an average, about two hundred insects a day. If we take fifteen days as the average time that young birds remain in the nest, the young during this time would devour about three thousand insects. A recent bird-census of the United States, made by the Bureau of Biological Survey, showed that there was an average of one pair of birds per acre on the farms of the eastern United States. East of the Mississippi River there are about 375,000,000 acres of farmland supporting an equal number of pairs of birds. These birds in rearing one brood of young would destroy about 1,100,000,000,000 insects. This is the amount for only two weeks eaten by the young birds alone while in the nest. To get some conception of the total amount of food eaten by all birds, to this must be added the insects eaten by the second and third broods which some species raise, those eaten by the

adult birds, and those eaten by the young birds after leaving the nest. The amount eaten by the young after leaving the nest and by the adults in a month would doubtless equal the amount required to feed the young for a half-month in the nest. This would make a monthly total of about 2,000,000,000,000 insects destroyed by birds on the farms of the eastern United States, or for the summer season about 10,000,000,000,000 insects.

If these insects averaged an inch in length and were placed end to end, they would make a procession 160,000,000 miles long, which, if it were to travel at the rate of a mile a minute, would require three hundred years to pass any given point. This would reach to the sun and almost back again; it would reach the moon and return three hundred times; it would encircle the earth sixty-four hundred times. If the insects were placed side by side one inch apart they would make a band fifty feet wide extending to the moon, and would form a belt five hundred feet wide extending all the way around the earth. These insects, if placed an inch apart each way would form a sheet that would completely cover the State of Delaware.

Control of outbreaks of insects. One feature of birds that makes them such a successful check upon insects is their power of flight. Wherever insects are found in unusually large numbers, there birds quickly gather to prey upon them. When the Mor-

mons first settled in Utah, their crops were attacked by the crickets and nearly destroyed, until the gulls came in large numbers and preyed upon the crickets and saved the remainder of the crops. In commemoration of this, a monument to the gulls has recently been erected in Salt Lake City.

Outbreaks of locusts in the Middle West have been controlled by birds. A serious outbreak of the forest tent-caterpillar occurred in New York and New England in 1897–98, but was finally brought under control by the action of the birds. An outbreak of the canker-worm occurred in an apple orchard in Illinois. A study of the birds found here showed that twenty-six kinds of birds were feeding on these canker-worms, which formed thirty-five per cent of the birds' food. There are many other records of small local outbreaks which have been controlled by the birds. But yet the greatest service that the birds render is in keeping the insects down to such a point that outbreaks do not occur.

Division of labor. The division of labor in those places where insects are found is well apportioned among the birds. Some birds, like the sparrows, feed upon the insects found on the ground; the woodpeckers spear those in the bark and wood of trees; warblers and vireos glean the small insects found on the leaves, while the larger birds, like the cuckoos, feed upon the larger insects found on the foliage; the swallows prey upon the insects in the air.

"Birds of a Maryland Farm." The figures so far given regarding the food habits of birds have been based largely on the averages for many birds collected from all parts of the country. But in some cases, in order to determine the value of birds in a particular locality, certain local facts regarding the crops raised and the insects present must be ascertained in order to decide definitely the economic status of the birds found there. Dr. Judd, of the Bureau of Biological Survey, made a careful study of a single farm of about two hundred and thirty acres in Maryland, in order to ascertain which birds were valuable and which were injurious on this particular farm. The farm was visited frequently during every month in the year for a period of seven years. A list of the available food-supply was made, consisting of insects, seeds, and fruit; the crops grown were noted, and the insects preying upon them. The birds were studied with reference to the kinds found, the abundance of each kind, their distribution, and especially with reference to their food habits. The birds were first studied in the field to ascertain on what they were feeding, and a few birds were shot and the contents of their stomachs examined. This study is one of the most valuable ever carried on along this line, and the results have been published in a bulletin entitled "Birds of a Maryland Farm."

The results found here so nearly parallel the general conclusions drawn from a study of birds through-

out the whole country, that a brief summary may be given. During this period 163 species of birds were observed. The stomachs of 298 birds were collected and examined. Considering the food of all the birds collectively, exclusive of the English sparrow, it was found that beneficial insects formed 4 per cent of the food, while injurious insects formed 27 per cent; grain formed 1¼ per cent, while weed seeds formed 18 per cent. This food may be grouped as follows: —

Food beneficial to man	*Per cent*	*Food injurious to man*	*Per cent*
Beneficial insects...	4	Injurious insects....	27
Grain.....	1¼	Weed seeds.....	18
Total.....	5¼	Total.....	45

The injurious food is thus seen to equal in amount nine times the beneficial food; or, in other words, the birds did nine times as much good as harm. A small amount of cultivated fruit was eaten, but the exact per cent was not given in the bulletin.

Birds and human health. It is now well known that some insects carry diseases and thus are the indirect causes of sickness and death. The house-fly and mosquito are the two most common and deadly insects in this way. The house-fly carries typhoid fever, tuberculosis, children's diseases of the alimentary canal, and many other diseases. Mosquitoes carry malaria and yellow fever, and are the only means known by which these diseases are carried from one person to another. And even in the north-

ern sections of the country where these diseases are not found, mosquitoes are a great pest and prevent one from enjoying outdoors at the best time of the year. The food habits of birds may be studied with special interest in this connection to see to what extent they feed on flies and mosquitoes.

The reports of the Bureau of Biological Survey show that there are a number of birds known to eat these insects. Nine species of shore-birds are known to feed on the wigglers of mosquitoes. In a killdeer's stomach, hundreds of larvæ of the salt-marsh mosquito have been found. Fifty-three per cent of the food of twenty-eight northern phalaropes from one locality consisted of mosquito larvæ.

The following land-birds are known to feed on the adult mosquito: nighthawk, purple martin, yellow-throated vireo, whip-poor-will, chimney swift, wood pewee, phœbe, kingbird, bank swallow, cliff swallow, tree swallow, barn swallow, violet-green swallow, wren-tit, and summer warbler. Five hundred mosquitoes are said to have been found in the stomach of a single nighthawk. Among the species eaten by this bird is the kind that carries malaria, so that, as we watch a nighthawk soaring around at twilight, we may believe it quite possible that it has been the means of saving some human life by destroying malaria-laden mosquitoes which might otherwise have bitten and infected a human being, thus causing sickness or death.

A bob-white kept in captivity ate 568 mosquitoes in two hours.

The following birds have been known to feed on house-flies: wood pewee, phœbe, yellow-throated vireo, martin, bob-white, and horned lark.

A bob-white kept in captivity ate 1350 flies in one day.

Mr. E. H. Baynes, in his "Wild Bird Guests," writes: —

> The pair of phœbes on our piazza, with two pairs of tree swallows which nest in boxes in the garden, and a pair of barn swallows in the barn, keep our house practically free from flies and mosquitoes all summer long.

CHAPTER VIII

FRIENDS AMONG THE BIRDS AS DESTROYERS OF WEED SEEDS

Harm done by weeds. Weeds constitute one of the greatest enemies against which the farmer or gardener must contend. During the growing season he must wage a constant warfare against them. Weeds may be injurious in the following ways: (1) Weeds interfere with the growth of crops by depriving them of plant-food, moisture, and sunlight and thus reduce the yield. (2) Another loss results from the mixture of weed seeds with the seeds of farm crops. It has been estimated that in the State of Minnesota alone the damage due to weed seeds amounts yearly to two and a half million dollars. (3) Weeds interfere with the harvesting and curing of crops. (4) Some weeds harbor insect pests and fungus diseases, which may injure crops growing near. (5) Some weeds are poisonous either to man or to livestock. A recent bulletin published by the Department of Agriculture estimated that weeds cost the American farmer three hundred million dollars every year.

The seed period of the weeds is one of the most vital at which they may be attacked. It is the migration stage during which they are spread from

FOX SPARROWS, EATERS OF WEED SEEDS

place to place. Many of the troublesome qualities which weeds possess are due indirectly to certain characteristics of the seeds: (1) the enormous number produced by a single plant; (2) their remarkable adaptations for dispersal; and (3) their wonderful vitality.

Productivity of weeds. A single plant of many common weeds like the foxtail and the lamb's-quarters may produce 25,000 seeds. It has been estimated that a single plant of purslane may produce 100,000 seeds; of pigweed, 300,000; of lamb's-quarters, 1,800,000; and of wormseed, 26,000,000. At Ames, Iowa, a square rod of ground in a garden, which had been in potatoes the year before and cultivated with a hoe, yielded 187,884 plants of eight common weeds.

Dispersal of weed seeds. The seeds of weeds are well adapted for dispersal. Many are scattered by the wind; some of the tumble-weeds are rolled along on the prairies; some have winglike attachments, like the docks; others have hairlike appendages, like the dandelions. Others have hooks by means of which they may be attached to clothing and fur and thus be carried long distances.

Vitality of weed seeds. And then, finally, after the seeds have reached their resting-places, they may retain their vitality and be able to germinate after many years of exposure to winter cold and summer drought. The seeds of most of our common weeds

retain their vitality from three to five years. The mustard seeds may retain theirs for ten years. In one study made on the longevity of seeds, some seeds of the Indian mallow and shoo-fly germinated after a lapse of fifty-seven years, and the seed of white sweet clover after seventy-seven years.

Birds as destroyers of weed seeds. We have already seen that another enemy of the farmer is the insect, and it is a very interesting and remarkable fact of vital importance to the farmer that one of Nature's means of controlling both these pests is the same, namely, the birds. Sometimes one group of birds helps to control the insect pests, and another group helps to control weed pests, but in many cases the same birds help to control both insect and weed pests, as is the case with the native sparrows. In fact, in the great majority of cases those birds which feed upon weed seeds also feed upon insects, although there are many birds which feed upon insects that do not eat weed seeds.

There are two or three hundred kinds of birds known to eat weed seeds to some extent, and about one hundred kinds of weed seeds are known to be eaten. The birds which are most effective in controlling weeds are the bob-white, the mourning dove, and the native sparrows. The seeds most commonly eaten are those of ragweed, pigeon-grass, crab-grass, bindweed, purslane, smartweed, pigweed, and lamb's-quarters.

The percentage of weed seeds eaten by some of the more effective weed-seed destroyers are shown in the following table, based on the reports of the Bureau of Biological Survey: —

Name of bird	*Per cent of whole food that weed seeds form*
Mourning dove	64
Horned lark	64
Cowbird	60
Red-winged blackbird	55
Chipping sparrow	53
Bob-white	50
Song sparrow	50
Vesper sparrow	42
Field sparrow	40

The following table, also based on the reports of the Bureau of Biological Survey, shows the number of different kinds of weed seeds known to be eaten by certain species of birds: —

Name of bird	*Number of kinds of weed seeds eaten*
Crow blackbird	6
Rose-breasted grosbeak	14
Red-winged blackbird	14
Cowbird	17
Horned lark	38
Cardinal	39
Bob-white	129

Amounts eaten. As birds are capable of eating enormous quantities of insects, so, too, some eat enormous quantities of weed seeds. It is common for a crow blackbird to eat from thirty to fifty seeds of smartweed, and a field sparrow one hundred seeds of crabgrass, at one meal. Dr. Judd estimated that

on an acre of land on a Maryland farm, the 540 birds found there destroyed 46,000 weed seeds at a single breakfast.

Mr. E. H. Forbush, during one winter, fed the birds at his window with seeds of Japanese millet, a sort of weed improved by cultivation, whose seeds are larger than those of most weeds. Records were kept of the number of seeds eaten in a certain time. It was found that the three species feeding averaged each to eat thirty-five seeds per minute. Assuming that each bird fed on weed seeds at this rate for only one hour a day, it would destroy 2100 seeds daily, or 14,700 weekly.

The following table, based on the reports of the Bureau of Biological Survey, shows the number of weed seeds that have been found in a single stomach of various birds: —

Name of bird	*Number of weed seeds*	*Kind of weed*
Crow blackbird	50	Smartweed
Field sparrow	100	Crabgrass
Chipping sparrow	150	Crabgrass
Tree sparrow	700	Pigeon-grass
Snow bunting	1,500	Amaranth
Mourning dove	7,500	Yellow wood-sorrel
Bob-white	10,000	Pigweed

It is estimated that in the States of Virginia and North Carolina, the bob-white consumes thirteen hundred tons of weed seeds in eight months.

GOLDFINCH

Professor Beal estimates the amount of weed seed annually destroyed by the tree sparrow in Iowa as follows: —

> On the basis of one fourth of an ounce of seed eaten daily by each bird, and an average of ten birds to each square mile, remaining in their winter range two hundred days, there would be a total of 1,750,000 pounds, or 875 tons, of weed seed consumed in a single season by this one species. Large as are these figures, they unquestionably fall far short of the reality.

Effect on weed-patches. Studies that have been made of patches of weeds after being visited by birds show that the work of destroying the seeds is done very effectively by them. In April, Dr. Judd examined weed-patches on a farm in Maryland to see to what extent the seeds had been destroyed. In one field, where in the fall there had been scores of seeds on every ragweed plant, it was difficult to find, during a fifteen-minute search, half a dozen seeds remaining. In another field, in a thick growth of pigeon-grass, where there had been hundreds of seeds in the fall, sometimes not a single one was found; and on a mat of crabgrass, where there had been thousands in the fall, frequently not one was left.

The native sparrows are specially efficient destroyers of weed seeds, and sometimes in two months will destroy ninety per cent of the seeds of pigeon-grass and ragweed. Weed seeds form more than half of their food for the entire year, and during the colder

half of the year they form about four fifths of the food of some sparrows. Most of the work of destroying weed seeds is done between early autumn and late spring. During the summer the birds feed largely on insects.

Mr. H. W. Henshaw, chief of the Bureau of Biological Survey, estimates that in the year 1906 the weed-seed-eating birds saved to the farmers of the country $35,000,000, on the assumption that the destruction of these weed seeds resulted in the saving of only one per cent of the crop.

CHAPTER IX

FRIENDS AMONG THE BIRDS AS DESTROYERS OF RODENT PESTS

Harm done by rodents. Another enemy of the farmer is the group of animals called rodents, such as mice, rats, ground squirrels, and rabbits, which destroy crops. The ground squirrels damage grain and forage crops to the extent of many millions of dollars annually; and it is known that they carry the germs of bubonic plague. The leopard ground squirrel, found in the western United States, digs up newly planted corn, and eats clover and alfalfa. The gray ground squirrel, found in the Dakotas and the neighboring States, feeds upon young chickens. Some squirrels destroy eggs of valuable birds. In the Middle West, the prairie dogs cause great damage by feeding on grains, and their burrows and hillocks are troublesome. Rats and mice are the most harmful rodent pests found on the farm. They eat almost any vegetable or grain crop and girdle fruit-trees. The rat carries disease-germs, being especially connected with the transmission of bubonic plague. The meadow mouse destroys meadows by tunneling under them and eating the roots of grass.

Rabbits, on account of their size and abundance,

do much harm. They eat all sorts of plant products, including grains and vegetables. The softer products constitute their summer food, and in the winter, bark and twigs are eaten, damage being done by girdling fruit-trees. In the West they are especially destructive to melons, pears, and cabbages.

Pocket gophers live on a great variety of plant products and are especially destructive to potatoes and alfalfa, and do much damage to fruit and shade trees.

Value of hawks and owls. Nature's chief checks for controlling these rodent pests are the hawks and owls, whose food consists largely of these injurious animals, although insects, poultry, and wild birds form minor items of their food. These two groups of birds supplement each other, the hawks working by day and the owls by night. As with other birds, so here, enormous quantities of food are eaten. It is the habit of owls to disgorge pellets of indigestible matter — bones, fur, etc. — taken with their food. An examination, made by Dr. A. K. Fisher, of the pellets found during a summer beneath the nest of a pair of barn owls showed the presence of 432 skulls of mice and rats, out of a total of 454 skulls found in 200 pellets. A similar study of long-eared owls in another locality, made during several winter months, showed that each owl on the average destroyed two mice a day. Under the nest of a pair of

great horned owls there were found at one time the remains of over 100 rats.

No group of birds has been so misunderstood as the hawks and owls. A few hawks do damage to poultry, and the belief is somewhat prevalent that all hawks and owls are injurious. It is as though the whole human race were to be judged by the criminals found in jails and prisons. It is unfortunate that there should be this misunderstanding regarding these birds, because, excepting five or six kinds, they are man's friends, constituting, as they do, about the only natural check now left on these rodent pests.

Bounties. During years past bounties have been offered in some States on all hawks and owls, and as a result great harm has been done the farmer, who has suffered more severely through the increase of rodent pests which followed the destruction of their enemies. Through ignorance of the economic value of these birds, in 1885 a law was passed in Pennsylvania placing a bounty of fifty cents on each hawk and owl. In a few years so many of these birds were killed that there was an increase in the amount of harm done to crops by rodent pests, so that the farmers had the bounty law repealed. Dr. C. Hart Merriam estimated that, as a result of this bounty law and the consequent destruction of about one hundred thousand hawks and owls, the State of Pennsylvania suffered an annual loss to its agricul-

tural interests of two and a half million dollars, or that the State threw away $2105 for every dollar saved.

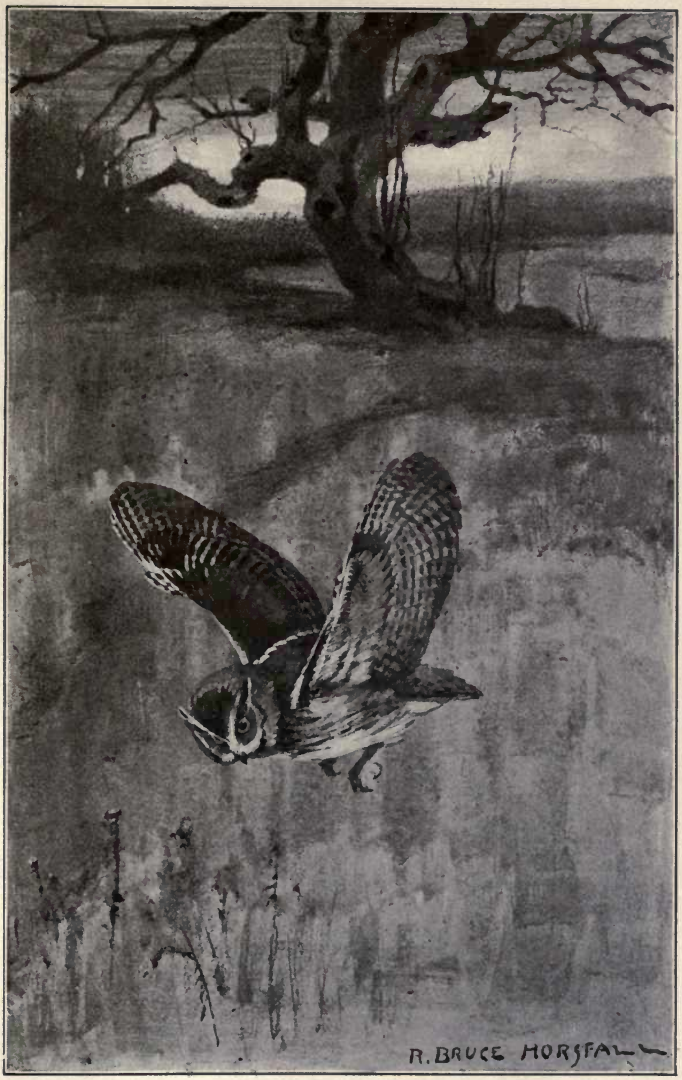
Study of food of hawks and owls. The Bureau of Biological Survey has made a very careful study of the food habits of the hawks and owls, and as a result these birds are divided into four groups by Dr. A. K. Fisher, who had charge of the investigations: ——

(1) *Species which are wholly beneficial.* To this class belong six species: the large rough-legged hawk, the squirrel hawk, or ferruginous rough-leg, and the four kites.

(2) *Species chiefly beneficial.* This class contains a majority of the hawks and owls, including twenty-nine species, of which the following are among the more common: marsh hawk, red-tailed hawk, red-shouldered hawk, Swainson's hawk, broad-winged hawk, sparrow hawk, barn owl, long-eared owl, short-eared owl, and screech owl.

(3) *Species in which beneficial and harmful qualities about balance.* This class includes seven species: the golden eagle, bald eagle, pigeon hawk, Richardson's hawk, Aplomado falcon, prairie falcon, and great horned owl.

(4) *Harmful species.* This class contains five species: the gyrfalcons, duck hawk, goshawk, sharp-shinned hawk, and Cooper's hawk. Of these the first three are so rare that they do not need to be



SCREECH OWL

taken into account, thus leaving only two injurious hawks and no injurious owls that are at all common. The chief harm done by the birds in this class is in destroying poultry and valuable insectivorous and game birds.

Thus approximately ten per cent of the species of hawks and owls are harmful, fifteen per cent are neutral, and seventy-five per cent are beneficial.

Some bird-students place the pigeon hawk and great horned owl in the harmful group instead of the neutral group, the former on account of the number of song-birds destroyed, and the latter on account of the poultry and game-birds eaten.

The following table is based on the results of a study of hawks and owls made by the Bureau of Biological Survey. In this study about twenty-seven hundred stomachs were examined. The percentages here given are based on the number of stomachs found to contain the different articles of food. A more accurate estimate would be obtained by estimating the percentage of the total amount of food, but the table gives a fair estimate of the economic status of each bird. In many cases the stomachs were found empty, and in computing this table the percentages have been based on the number of stomachs found with food. By this method of computing the percentages, the sums for one bird total more than one hundred, because usually a bird had fed on several kinds of food.

FOOD CHART OF HAWKS AND OWLS

(Based on number of birds eating various foods)

Name of bird	*Per cent eating mammal pests*	*Per cent eating insects*	*Per cent eating poultry and game-birds*	*Per cent eating other birds*
Chiefly beneficial species				
Red-tailed hawk..	86	10	11	10
Red-shouldered hawk.....	70	45	1½	6
Marsh hawk.....	68	12	6	30
Broad-winged hawk.....	50	52	0	3½
Sparrow hawk...	34	72	⅓	18
Short-eared owl..	96	8	0	12
Long-eared owl...	96	1	1	16
Barred owl.....	72	16	6	15
Screech owl.....	48	47	½	13
Neutral species				
Great horned owl.	71	9	28	7
Pigeon hawk.....	4	31	4	80
Harmful species				
Cooper's hawk...	12	2	36	55
Sharp-shinned hawk.....	6	5	6	92
Average.....	55	24	8	27

The table shows that approximately seven times as many birds had eaten mammal pests as had eaten poultry and game-birds.

The results of these studies were published in a bulletin in which the economic status is briefly summarized as follows: —

The result proves that a class of birds commonly looked upon as enemies to the farmer, and indiscriminately destroyed whenever occasion offers, really rank among his best friends, and with few exceptions should be preserved and encouraged to take up their abode in the neighborhood of his home. Only six of the seventy-three species and subspecies of hawks and owls of the United States are injurious. Of these, three are so extremely rare that they need hardly be considered, and another (the fish hawk) is only indirectly injurious, leaving but two (the sharp-shinned and Cooper's hawks) that really need to be taken into account as enemies to agriculture. Omitting the six species that feed largely on poultry and game, 2212 stomachs were examined, of which 56 per cent contained mice and other small mammals, 27 per cent insects, and only 3½ per cent poultry and game-birds. In view of these facts the folly of offering bounties for the destruction of hawks and owls, as has been done by several States, becomes apparent, and the importance of an accurate knowledge of the economic status of our common birds and mammals is overwhelmingly demonstrated.

Money value of hawks and owls. Mr. H. W. Henshaw, chief of the Bureau of Biological Survey, estimates that Swainson's hawk saves the Western farmers one hundred thousand dollars a year through the destruction of injurious insects and small rodents.

Dr. C. Hart Merriam, former chief of the Bureau of Biological Survey, estimates the value of a hawk or owl as follows: —

It is within bounds to say that within the course of a year every hawk and owl destroys at least a thousand

mice or their equivalent in insects, and that each mouse or its equivalent so destroyed would cause the farmer a loss of two cents per annum. Therefore, the lowest estimate of the value to the farmer of each hawk and owl would be twenty dollars a year.

Mr. E. H. Baynes estimates the money value of a pair of marsh hawks substantially as follows: Eight meadow mice have been found in the stomach of a single marsh hawk. Assuming on the average that the bird destroys only half this number each day, a pair would destroy 2920 mice in a year. It has been estimated that each mouse causes an annual loss to the farmer of two cents in damaging crops. Thus the destruction of 2920 mice means the saving of $58.40, which represents the yearly money value of a pair of marsh hawks.

CHAPTER X

FOES AMONG THE BIRDS

Birds may be harmful to man in the following ways: (1) by eating cultivated fruits; (2) by eating grains; (3) by destroying poultry; (4) by injuring trees and wood products; (5) by feeding on beneficial insects; (6) by injuring other birds which are valuable.

Fruit-eaters. A number of birds eat cultivated fruits to a greater or less extent. The fruits chiefly damaged are the smaller ones, such as strawberries, raspberries, blackberries, cherries, and olives, and sometimes grapes may be punctured. The chief fruit-eating birds, arranged in the order of the percentage which fruit forms of the whole food, are shown in the following table: —

Name of bird	*Per cent of whole food that cultivated fruits form*
Catbird	19
Cedar-bird	13
Brown thrasher	8
Robin	8

In certain localities the injury done may be very serious. During the winter of 1900–01 enormous numbers of robins visited the olive orchards of some portions of California and did thousands of dollars

worth of damage, in some orchards ruining from one fourth to one half the crop.

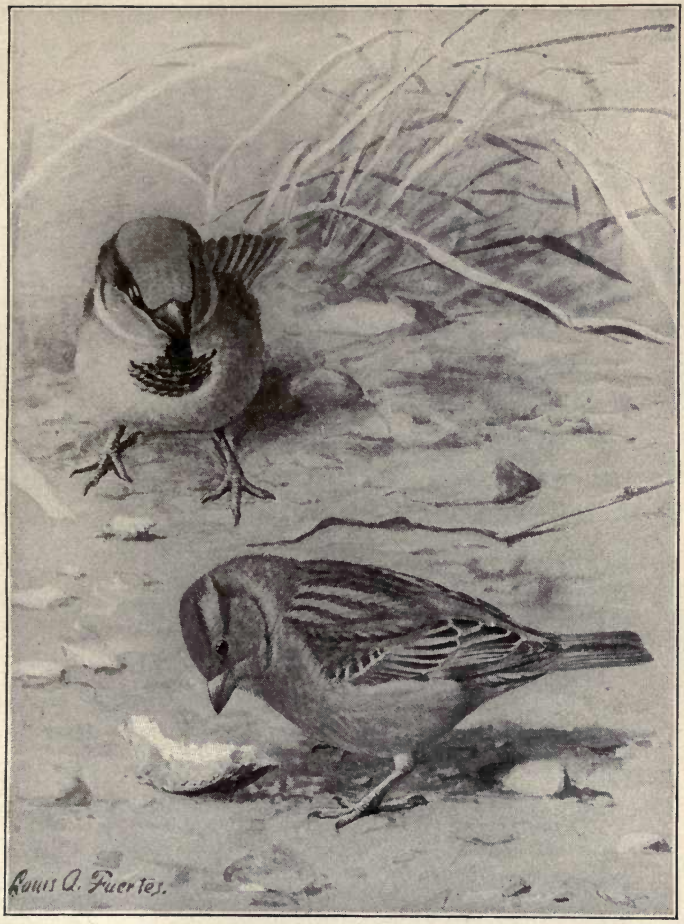
There is seldom any widespread complaint regarding the harm done by birds in destroying fruit, the injury usually being confined to some small locality where there has been an increase in the number of fruit-eating birds or a decrease in the supply of wild fruit on which these birds usually subsist.

The remedy is not found in permitting wholesale slaughter of these birds throughout the whole country, but it may be necessary to allow shooting in those localities where the harm is done, so that the fruit-growers may protect themselves. Those birds which feed on cultivated fruits feed to an even greater extent on wild fruits, which if present in sufficient quantities, are usually preferred to the cultivated.

Complaints against the robin have come chiefly from two sources, the suburbs of large towns in the East and the prairie region of the West. In these localities those wild fruits which robins prefer are naturally lacking, and hence the robins turn to the cultivated fruits.

Injury to grain. Several birds do considerable damage to grain, either to the newly planted seed in the spring, or to the matured grain in the fall. The grains chiefly affected are corn, wheat, and oats. The birds that feed upon grain, in the order of the

UNIV. OF CALIFORNIA



ENGLISH SPARROW
Upper, male; lower, female

UNIV. OF
CALIFORNIA

percentage that grain forms of the whole food, are shown in the following table: —

Name of bird	*Per cent of the whole food that grain forms*
English sparrow	74
Crow blackbird	46
Crow	29
Cowbird	16
Red-winged blackbird	14

The crow does damage chiefly to the sprouting grain, the other birds to the maturing crop. The crow and crow blackbird do their chief damage to corn. The red-winged blackbird is especially destructive in the Mississippi Valley. Favorable conditions for breeding are found in the sloughs and marshes, and after the young have left the nest, large flocks may settle upon grain-fields and do damage, both by eating the grain and by breaking down the straw and making it difficult to cut.

These birds do not seem to be especially fond of grain as compared with wild foods, but are driven to eating it on account of an excessive number of birds of the same kind living in a limited area. In time a proper equilibrium will probably be established, when the birds will exist in smaller numbers and hence do less damage. A study of the months when this grain was eaten and of the places where it was collected shows that it was probably at least half waste grain collected in the fields or on the ground after the grain had been harvested, so that this

represents no loss to the farmer and should not be counted against the birds.

The bobolink in rice-fields. In the North the bobolink is beneficial in its feeding-habits and has associated with it some of the pleasantest memories of the springtime. But in the South, until recently, the case was entirely different. The birds arrive in the South in April just after the rice seeds have been planted and do some damage to the sprouting grain. The birds nest in the northern part of the United States and after the breeding-season is over gather in flocks and migrate southward, and used to arrive in the rice-fields the last of August, and for two months were present in millions, during which time rice constituted almost their entire food. These birds caused great loss to the rice-grower, estimated at two million dollars annually. There was the direct loss due to the eating of the rice and the indirect loss on account of the expense involved in the methods used to keep off the bobolinks. Men and boys were posted in the rice-fields from sunrise to sunset to fire blank cartridges and thus frighten off the birds.

Formerly the harm done by the bobolinks in the South by eating rice was greater than the good done by them in the North in destroying injurious insects and weed seeds. But the injury now done is considerably less than formerly, as is shown by the following quotation from a recent bulletin of the Bureau of Biological Survey: —

Formerly, when the low, marshy shores of the Carolinas and some of the more southern States were devoted to rice-culture, the bobolinks made great havoc upon the sprouting rice in spring and upon the ripening grain on their return migration in the fall. With a change in the rice-raising districts, however, this damage is no longer done.

Destruction of poultry. Some of the hawks and owls destroy poultry, but, as already pointed out in discussing the value of these birds in destroying rodents, this is the exception and not the rule. Only one common hawk, Cooper's hawk, does any serious damage in the poultry-yard. The sharp-shinned hawk, which is one of the injurious hawks, is too small to do much damage to the larger fowl, and finds its food chiefly among the small native birds. Other hawks and owls occasionally destroy poultry, but the harm done is much more than balanced by the good done in destroying mammal pests. Following is a list of hawks and owls arranged in the order of the percentage of individuals that had eaten poultry: —

Name of bird	*Per cent of birds that had eaten poultry*
Cooper's hawk	36
Great horned owl	28
Red-tailed hawk	11
Marsh hawk	6
Sharp-shinned hawk	6
Barred owl	6

The percentage of the others is zero, or so small as to be negligible.

Damage to trees and wood products. Woodpeckers drill small holes in trees to obtain insects and make large holes for nesting-sites. When these are made in dead wood, no harm is done, but when made in living wood, some slight harm may result, and occasionally telephone-poles are weakened by holes bored by woodpeckers. On the whole, the harm done in these ways is very slight and does not deserve serious consideration in the light of the good these birds do. But there is one woodpecker which does serious damage both to living trees and to wood products made from trees; that is the sapsucker, of which there are three species in the United States, the yellow-bellied sapsucker being the only one found in the eastern United States.

The sapsucker feeds to a large extent on the bast, or inner layer of the bark, the cambium, or growing tissue, and the sap of trees. In order to obtain this food, holes are drilled into trees. These are often arranged in rings around the tree and may girdle it. Strips of bark between the holes may also be removed.

Since the inner bark is one of the channels through which sap passes in the tree, the removal of this bark seriously interferes with the growth of the tree. The tree may simply have its vitality lowered, or a few branches may die, or the whole tree may die, depending on the number and arrangement of the holes. These holes furnish opportunity for insects and fungi to enter and do further harm. Altogether

the yellow-bellied sapsucker has been known to attack 246 species of native trees and 31 kinds of introduced trees, a total of 277 trees. Of these, 29 species are known sometimes to have been killed, and 28 others are known to have been disfigured or seriously reduced in vitality.

But the damage done is not confined to the living trees. Of greater commerical loss is the resulting injury to the wood products after the tree is cut down. When the tree heals and new wood grows around the holes made by the sapsucker, blemishes of various kinds may appear, such as staining, distortion of the grain, or formation of knotty growths and cavities. As a result, the value of the wood is reduced. These defects especially render unfit for use the woods used for ornamental purposes, such as mahogany and black walnut; they may blemish woods valuable for some special quality, such as hickory; and sometimes they may even destroy the value of wood used for heavy construction purposes, such as Western hemlock and Southern basswood. The wood of one hundred and seventy-four species of trees has been found to contain defects due to sapsucker work. It is estimated that one tenth of all the trees within the sapsucker's range bears marks of his work, and so wood of one tenth of the trees would contain defects. This matter has been carefully investigated by the Bureau of Biological Survey, with the result that it is estimated that the

annual loss due to the sapsucker is a million and a quarter dollars.

Destroying beneficial insects. Some insects are helpful to man, such as the parasitic and predacious insects that prey upon injurious insects, the bees and wasps that pollinate fruit flowers, and the honey-bee, which produces honey. It is to be expected that birds in their search for insects would feed on the beneficial forms as well as those that are injurious to man. To what extent these insects form a part of birds' food and how this compares with the amount of injurious insects eaten are questions to be investigated in determining the economic status of birds. The worst offenders in this line of destroying beneficial insects are found in the family of flycatchers, including the phœbe, kingbird, chebec, and wood pewee. These insects are also eaten to some extent by the swallows and warblers.

Dr. Judd found in his studies of the "Birds of a Maryland Farm," after an examination of about seven hundred stomachs representing one hundred and sixty-three species, that beneficial insects formed four per cent of their food while injurious insects formed twenty-seven per cent. This would probably hold true for birds as a class, that their food contains seven times as many injurious as beneficial insects. The small size of many parasitic insects helps to explain why birds feed on these insects to such a small extent.

It does not always follow that birds are doing harm when destroying these beneficial insects. In the case of the small parasites, their presence in the bird's stomach suggests that probably these insects at the time were unusually abundant and probably little harm was done by destroying their excess. In the case of parasitic insects eaten during the latter half of the summer, there would not have been sufficient time for these to become effective even had they lived. There is also to be considered the fact that the parasites often destroy useful insects or are destroyed by other insects. So that when all things are taken into consideration in this complicated problem, the amount of harm done by birds in eating beneficial insects is not so great as might at first appear.

Injury to valuable birds. Some birds may be harmful by injuring other birds which are distinctly valuable. In some cases the adult birds may be killed and used for food. The worst offenders are the sharp-shinned hawk, Cooper's hawk, pigeon hawk, and the great horned owl, especially the sharp-shinned hawk, more than half of whose food consists of small valuable birds. This hawk has been known to feed on forty-six kinds of birds. Other hawks and owls, but to a much less extent, may occasionally feed on song-birds. Beneficial birds form about one fourth of the food of the shrike, or butcher-bird. In other cases birds may

destroy the eggs and nestlings of other small birds. The crow, blue jay, crow blackbird, and English sparrow are offenders along this line.

In still another, indirect, way birds may injure other birds, by occupying their nesting-sites. This is one of the chief ways in which the English sparrow is harmful, because it preëmpts both the natural nesting-sites and the boxes provided for such birds as the martin, the tree swallow, and the bluebird, and often drives them away when they do select a nesting-site. In many sections these birds are decreasing in numbers on account of the persecutions of the English sparrow. It may destroy the eggs and young of these birds and even attack other birds that do not use similar nesting-sites.

The starling, which is now found in the East, seems to be having a similar effect, but, being a larger bird, is affecting other birds such as the flicker. The cowbird also does some injury through its habit of laying its eggs in the nests of other birds, because the raising of the young usually means the death of several young birds found in the nest with it.

Preventing depredations of the birds. In many cases the harm that birds do can be greatly lessened by observing certain precautions, and the birds may still be retained for the good they do. The harm done by crows in the spring in pulling up corn may be greatly lessened by coating the corn with tar. Small fruits may be protected by planting wild

fruits that ripen at about the same time. Birds usually prefer these wild fruits to the cultivated. Strawberries and cherries may be protected by planting the Russian mulberry and June-berry. Blackberries and raspberries may be protected by planting mulberry, elder, and chokecherry. Grapes may be protected by planting elder, Virginia creeper, and black cherry.

CHAPTER XI

STRIKING THE BALANCE

HAVING taken up in turn the good done by the birds and the harm done, the question naturally arises as to how these two compare. The following standard has been given by Dr. Judd for determining the economic status of a bird: —

> For a rough general estimate it is safe to assume that a bird that feeds on insects, seeds, and fruit, and is abundant on a farm, will do more good than harm, and usually be worthy of protection, when the neutral part of its food forms less than half of its entire food and its beneficial food amounts to several times its injurious food.

Applying this standard to our common birds, they may be divided into three groups: injurious, neutral, and beneficial.

To the injurious group belong four common birds: the English sparrow, the sapsucker, Cooper's hawk, and the sharp-shinned hawk.

In the neutral group may be placed those birds in which the beneficial and harmful qualities about balance. This includes five birds: the catbird, the cedarbird, the crow, the crow blackbird, and the blue jay.

The remainder of our common birds belong to the beneficial group. This group may be further sub-

divided into two classes, those chiefly beneficial and those almost wholly beneficial.

In the class of chiefly beneficial birds may be placed those which may at times do appreciable harm, but which, taken the country over and throughout the entire year, do much more good than harm. This would include the bobolink, the cowbird, the red-winged blackbird, the robin, the brown thrasher, the bluebird, the mourning dove, the meadowlark, the phœbe, the kingbird, the chebec, the wood pewee, and the red-headed woodpecker.

To the group of almost wholly beneficial birds belong the remainder of the common birds, which do so little harm that it is of small economic importance. Such birds are the thrushes, the vireos, the native sparrows, the cuckoos, the wrens, the swallows, the warblers, the chickadees, the woodpeckers, and the bob-white.

The birds included in each of these four groups are given in the following table and the harm and good done by each briefly indicated: —

INJURIOUS BIRDS

Name of bird	*Harm done*	*Good done*
Cooper's hawk.	Eats poultry and native birds.	Eats a few mice.
Sharp-shinned hawk.	Eats poultry and native birds.	Eats a few mice.
Sapsucker.	Injures trees and wood products.	Eats some insect pests and weed seeds.
English sparrow.	Eats grain; drives away native birds.	Eats insect pests and weed seeds.

NEUTRAL BIRDS, OR BIRDS OF DOUBTFUL UTILITY

Name of bird	*Harm done*	*Good done*
Catbird.	Eats cultivated fruit.	Eats insect pests.
Cedar-bird	Eats cultivated fruit.	Eats a few insect pests.
Crow.	Eats grain, and eggs and nestlings of valuable birds.	Eats insect pests.
Crow blackbird.	Eats grain, and eggs and nestlings of valuable birds.	Eats some insect pests and weed seeds.
Blue jay.	Eats grain, and eggs and nestlings of valuable birds.	Eats some insect pests.

BIRDS CHIEFLY BENEFICIAL

Name of bird	*Harm done*	*Good done*
Red-winged blackbird.	Eats grain.	Eats insect pests and weed seeds.
Bluebird.	Eats beneficial insects.	Eats insect pests.
Bobolink.	Eats rice.	Eats insect pests and weed seeds.
Cowbird.	Destroys nestlings of other birds.	Eats insect pests and weed seeds.
Mourning dove.	Eats grain.	Eats weed seeds.
Flycatchers (kingbird, phœbe, pewee, chebec).	Eat beneficial insects.	Eat insect pests.
Meadowlark.	Eats grain and beneficial insects.	Eats insect pests and weed seeds.
Robin.	Eats cultivated fruit.	Eats insect pests.
Brown thrasher.	Eats cultivated fruit and beneficial insects.	Eats insect pests
Red-headed woodpecker.	Eats beneficial insects, grain, and cultivated fruit, and injures other birds.	Eats insect pests.

BIRDS ALMOST WHOLLY BENEFICIAL

Name of bird	*Good done*
Bob-white.	Eats insect pests and weed seeds.
Chickadee.	Eats insect pests.
Cuckoos (two species).	Eat insect pests.
Rose-breasted grosbeak.	Eats insect pests and weed seeds.
Nighthawk.	Eats insect pests.
Baltimore oriole.	Eats insect pests.
Native sparrows (about fifty species).	Eat insect pests and weed seeds.
Swallows (six species).	Eat insect pests
Vireos (six species).	Eat insect pests.
Warblers (about forty species).	Eat insect pests.
Woodpeckers (nine species).	Eat insect pests.
House wren.	Eats insect pests.

Taking one hundred species of birds as the number of more or less common birds that might be found in a locality, they would be divided approximately as follows:—

Injurious	4 per cent
Neutral	5 " "
Chiefly beneficial	13 " "
Almost wholly beneficial	78 " "

Or, to state the matter still more briefly, four per cent do more harm than good, and ninety-one per cent do more good than harm; that is, there are about twenty-two times as many species of beneficial birds as there are species of harmful birds.

So that when one comes to consider the total amount of harm done by birds under all conditions, and the total amount of good done under all conditions, and when to the economic value is added the great æsthetic value, we find that the amount of harm done is relatively insignificant, while the

amount of good done is of such tremendous importance that the birds stand out as one of man's greatest friends, both in adding to the pleasure of living and in aiding man to raise those crops on which his very existence depends.

Mr. Frank M. Chapman, the well-known bird authority, writes in his "Handbook of Birds": —

> The more we learn of the food habits of birds, the greater becomes the realization of our indebtedness to them, and economic ornithologists now agree that, without the services rendered by birds, the ravages of the animals they prey upon would render the earth uninhabitable.

Mr. H. W. Henshaw, chief of the Bureau of Biological Survey, writes in an article published in the "National Geographic Magazine": —

> What would happen were birds exterminated no one can foretell with absolute certainty, but it is more than likely — nay, it is almost certain that within a limited time not only would successful agriculture become impossible, but the destruction of the greater part of vegetation would follow. It is believed that a permanent reduction in the numbers of our birds, even if no species are exterminated, will inevitably be followed by disastrous consequences.

The food habits of a few common birds are briefly summarized in the following table, which is based on the reports of the Bureau of Biological Survey. In putting down the amount of grain eaten, the per cent of waste grain has been subtracted from the total per cent of grain eaten, thus leaving only

that portion which can be considered to the bird's discredit. The hawks and owls are not given here, as a table for them has been given in Chapter IX. The figures represent the per cent of the total food for the year that any item forms.

TABLE OF FOOD OF A FEW COMMON BIRDS

Name of bird	To bird's credit			To bird's discredit			
	Insect pests (per cent)	Weed seeds (per cent)	Total credit (per cent)	Cultivated fruit (per cent)	Grain (per cent)	Beneficial insects (per cent)	Total debit (per cent)
Crow-blackbird	19	4	23	3	22	6	31
Red-winged blackbird	20	57	77	..	7	5	12
Bluebird	47	..	47	..	..	9	9
Bob-white	10	50	60	..	5	..	5
Cardinal	24	36	60	..	4	2	6
Catbird	12	..	12	19	..	3	22
Cedar-bird	10	..	10	13	..	..	13
Cowbird	20	60	80	..	8	..	8
Crow	16	..	16	4	12	2	18
Cuckoo	88	..	88	..	..	..	..
Mourning dove	..	64	64	..	8	..	8
Flicker	55	..	55	..	1	2	3
Crested flycatcher	70	..	70	..	..	3	3
Least flycatcher	52	..	52	..	..	13	13
Rose-breasted grosbeak	45	16	61	..	2	5	7
Blue jay	19	..	19	2	9	4	15
Junco	17	62	79	..	4	..	4
Kingbird	50	..	50	..	..	13	13
Horned lark	15	64	79	..	2	..	2
Meadowlark	56	7	63	..	3	12	15
Baltimore oriole	58	..	58	..	..	..	..
Wood pewee	56	..	56	..	..	11	11
Phœbe	51	..	51	..	..	10	10
Robin	33	..	33	8	..	6	14
Chipping sparrow	28	53	81	..	2	1	3
English sparrow	..	24	24	..	74	..	74
Field sparrow	30	40	70	..	4	4	8
Song sparrow	18	50	68	..	2	2	4
Vesper sparrow	22	42	64	..	6	2	8
Brown thrasher	33	..	33	8	3	8	19
Wood thrush	38	..	38	4	..	2	6
Downy woodpecker	69	..	69	..	1	2	3
Hairy woodpecker	72	..	72	..	1	1	2
Red-headed woodpecker	21	..	21	3	4	9	16
House wren	69	..	69	..	..	6	6

CHAPTER XII

CHANGES IN THE NUMBERS OF BIRDS

THERE are certain natural agencies which tend to keep birds in check and prevent their too great increase, and these agencies are necessary to preserve the balance of nature, else birds might become so numerous as to be harmful. Since the white man came to this country he has been responsible both directly and indirectly for other agencies tending to check bird life. The question naturally arises as to whether all these causes combined are tending to reduce bird life to such a minimum that extermination of certain species is threatened, or their reduction to such small numbers that they are no longer able to keep insects in check. We will first investigate the question as to whether the birds have decreased in numbers, either as regards the number of species or the number of individuals.

Extinct birds. Within the past sixty-five years several species of birds, which were formerly found in some portion of the United States, have become extinct, and the last stages of the extermination of two species are being enacted at the present time. Two species, the great auk, and the Labrador duck,

are certainly extinct; one species, the passenger pigeon, is probably extinct; and one species, the Eskimo curlew, is nearly if not already extinct. In the case of three of these species it is known that destruction by man was the cause of the extermination. Following is the list: —

Name of bird	*Date of last one seen*	*Where found formerly*
Great auk (certainly extinct)	1853	Northern North America. Northern Europe.
Labrador duck (certainly extinct)	1875	Northern Atlantic Coast.
Passenger pigeon (probably extinct)	1908	Canada and Northern United States
Eskimo curlew (nearly extinct)	1913	Atlantic Coast of North America.

Besides these, five other species of birds, formerly found in the West Indies and one species found in the Bering Islands, have become extinct. Little is known of their history or of the cause of their extermination.

The passenger pigeon. The passenger pigeon was formerly found widely distributed in the United States east of the Rocky Mountains, and in such enormous numbers that it is difficult to appreciate the meaning of the records which were kept by men of that time. They passed in flocks which darkened the sun and required hours to pass over.

About a hundred years ago Alexander Wilson recorded a flight of pigeons which he estimated to be one mile wide and 240 miles long. Judged from the time it took to pass over, which was four hours, he estimated that this flock contained over 2,000,000-000 birds. These pigeons nested together in large colonies with many nests in a single tree. Audubon records a breeding-place several miles in breadth and forty miles in extent.

During the first half of the last century the birds decreased very noticeably in numbers and by the middle of the century this decrease was being noticed by bird-students, although enormous flocks were seen occasionally at this time, and even for twenty years later in certain States. The last large nesting-place was recorded in Michigan, in 1878, covering a space of 100,000 acres. But from this time on, the records of this bird became fewer and fewer, and the last authentic record was in 1908. A single bird was kept in captivity in the Cincinnati Zoölogical Garden for several years after this. This bird, believed to be the last of its race, died on September 1, 1914. Many efforts have been made in recent years to find the passenger pigeon and prizes offered, but without avail, so that we are driven to the conclusion that there is not now left a single living bird of a species which was, within the memory of men now living, the most abundant species of bird in this country.

The cause of this shameful extermination is well known. It was the capture of birds for sale in the market as food. It was the general custom during the migration season, when these enormous flocks appeared, for people to turn out and kill pigeons. Some hunters made it a business to follow them from place to place to secure them for market. In the days of their abundance they nested in large colonies in areas forty miles long and three or four miles wide. Great numbers of men, women, and children, armed with guns, clubs, and nets, came to these nesting-places and massacred both old and young birds during the entire night. The young in the nest were considered great delicacies. The birds were so numerous that they were easily killed in enormous numbers. Sometimes a single shot would kill dozens of birds.

They were also caught in nets and several hundred were so caught at one time. Sometimes a single hunter killed as many as a thousand pigeons in a day. They were hunted both day and night and were sent to market, where they were sold for twelve to fifty cents a dozen. In 1874, from a nesting-place in Michigan, one hundred barrels were shipped daily for thirty days, or about a million and a half birds. In another year about fourteen million birds were sent to market. In 1881, in another part of the same State, five hundred men were netting pigeons and took about ten million birds.

With such figures as these at hand it is easy to understand how the passenger pigeon became exterminated. The economic status of this species is not known, but the sad fate of the bird shows that any wild bird is in danger of extermination when it is hunted for commercial purposes.

The Eskimo curlew. The Eskimo curlew is another example of an abundant bird rendered nearly extinct through market demand. It was to be found on the Atlantic Coast in enormous flocks up to about fifty years ago. Since that time the bird has gradually disappeared, till now it is seldom seen. A few have been taken in the last three years, but it seems only a matter of a few years till it becomes absolutely extinct. The cause is the same as for the passenger pigeon, continued and unrestricted shooting to meet the market demand.

Species in danger of extermination. Other birds have been decreasing in numbers at such a rate that they are threatened with extinction unless some radical measures are taken to preserve those that are still left. Following are some of the birds which seem to be most in danger of extermination: Carolina paroquet, whooping crane, trumpeter swan, snowy heron, American egret, woodcock, and many shore-birds, including the golden plover, pectoral sandpiper, knot, upland plover, willet, and dowitcher.

Decrease of game-birds. There is general agree-

ment among all bird-students that there has been a very marked decrease among the game-birds, wild fowl, and shore-birds during the last twenty-five years, in some cases threatening extinction, as mentioned in the previous paragraph. In 1901, Mr. W. T. Hornaday sent a questionnaire to bird-students in all parts of the United States asking their opinion regarding the decrease in birds in their localities during the past fifteen years. One hundred and ninety reports were received. Almost without exception, these all agreed that there had been a very marked decrease in the number of game-birds, some estimating the decrease as high as ninety per cent.

Mr. E. H. Forbush, in 1907, made a detailed study of the conditions in the State of Massachusetts. A list of fifty-eight species of game-birds, wild fowl, and shore-birds was sent to about five hundred gunners and ornithologists in the State, and these were asked to report on the increase or decrease of each species. In the case of every species, some observers reported a decrease, while there were four species for which every one reported a decrease. For every one of the fifty-eight species, more observers reported a decrease than reported an increase. Usually the numbers reporting a decrease were much larger than those reporting an increase. Taking all the birds together, the average number of observers reporting an increase for each bird was ten, while the average number reporting a decrease

was sixty-four, so that for one region of the State where a bird had increased, there were six regions where it had decreased. For twenty species ten times as many observers reported the birds to be decreasing as to be increasing. The per cent of decrease reported ranged from fifty to seventy-five; the per cent of increase from twenty-five to fifty.

Have the song-birds decreased? These instances are enough to prove conclusively that the game-birds, wild fowl, and shore-birds have decreased very markedly. We may next inquire if this is also true of the common song-birds. In the report of Mr. Hornaday to which reference has already been made the statement is made that birds had decreased forty-six per cent during the previous fifteen years. In 1904, Mr. E. H. Forbush made a careful study of the relative abundance of song-birds found in Massachusetts. Reports were received from about two hundred bird-students to whom questions had been sent relative to the abundance of birds compared with that in previous years. From these reports Mr. Forbush concludes that the numbers of the smaller birds have remained about the same, excepting in and near towns and cities, where there has been a decrease. A decrease in herons, hawks, and owls was noted. The following quotation is taken from this report: —

The smaller native birds fluctuate, some species decreasing in some localities and increasing in others, but

apparently holding their own very well, in general. There may be a slight decrease in the aggregate, owing to the evident diminution of many species in and near cities, with no corresponding increase in the country. There appears to be no general and noticeable reduction in the rural sections except where the birds are subjected to an unusual amount of persecution. On the whole, the balance of life among the smaller birds seems to be fairly maintained.

Information received from other states along the Atlantic seaboard seems to indicate, that, as here, shore birds and game birds are decreasing, while the insectivorous birds are, with some exceptions, holding their own.

Comparing the conclusions of Messrs. Hornaday and Forbush with reference to the song-birds, we may note, first, that Mr. Hornaday's figures represent the decrease for all birds, game-birds included, while Mr. Forbush is speaking here of song-birds only; and furthermore, it is probable that some of those who answered Mr. Hornaday's questions had the game-birds specially in mind. So far as there is any discrepancy between these reports, doubtless Mr. Forbush's report is more nearly correct. His report was based on the observations of two hundred people from many parts of the State, while Mr. Hornaday's report, as far as Massachusetts is concerned, was based on the observations of only eleven people, more than half of whom lived in or near cities.

"Bird-Lore's" Christmas census. The readers of "Bird-Lore" have been making a Christmas

census of birds for about fifteen years. These records have now been kept long enough to throw some light on the question as to whether the winter birds have changed in numbers. In " Bird-Lore " for January–February, 1914, was published a summary of the reports from 1901 to 1911. Graphs are shown representing the abundance of ten species for the different years. The graphs for four species are very regular and show practically no change during the ten years. The graphs for five species are quite irregular, showing fluctuations from year to year, but on the average there is no tendency toward any regular change, either an increase or a decrease.

Mr. Frank L. Burns made a bird-census during the nesting-seasons of 1899–1901 of the birds found on a 640-acre farm in Berwyn, Pennsylvania. Thirteen years later, in 1914, he made another census of the same area. In the first census he found sixty-two species represented by 1388 individuals; in the last census he found sixty species represented by 1424 individuals. This would seem to indicate that on the whole birds were holding their own on this area. Mr. Burns writes, " The tendency seems to be toward a less varied fauna and increase of individuals of the more adaptive species."

United States census of birds. The Bureau of Biological Survey has begun taking a series of censuses which will eventually answer the question as

to whether birds are changing in numbers. The first census was taken in 1914. During the nesting-season of that year a census was taken by several hundred observers on farms situated in different parts of the United States, but chiefly in the northeastern section. These reports showed that there was an average of one pair of birds to the acre. At this rate there would be about 350,000,000 pairs of adult birds on the farms east of the Mississippi River. The following quotation is taken from a circular describing the census: —

That the present bird population is much less than it ought to be, and much less than it would be if birds were given proper protection and encouragement, is the most important deduction from this preliminary census. An approximate average of one pair of birds to each acre of land was found, but individual censuses showed that it is possible, under strictly farm conditions, very largely to increase this number. Near Wellington, Virginia, a tract of forty-nine acres of a dairy farm, of rather less than the average of ploughed ground, supported a bird population of one hundred and thirty-seven pairs, or three pairs to the acre. On a forty-acre farm in Rantoul, Kansas, after fourteen years of bird protection and encouragement, there were found one hundred and fifty-seven pairs of birds, or about four pairs of birds to the acre.

It is evident from the foregoing statement that double the present bird population is easily obtainable, while a threefold increase is well within the possibilities.

It was noticeable that the blocks most thickly inhabited by people were also most fully occupied by breeding birds. This is a striking refutation of the widespread belief that human beings and birds are naturally

antagonistic, and that as the population of the United States increases the number of birds must necessarily decrease.

On the author's place of three acres, situated on the edge of a city of ten thousand population, there were fifteen pairs of birds representing seven species, nesting during 1914. One village of twenty-three acres showed an average of seventeen pairs of birds per acre. One man in Chevy Chase, Maryland, reported thirteen pairs nesting in a half-acre yard. The record for the largest number of birds comes from a farm in Maryland, where fifty-nine pairs of birds were found nesting on a single acre.

In this census the robin was found to be the most abundant bird, with six pairs per farm of fifty-eight acres, and the English sparrow next, with five pairs per farm. For every one hundred robins reported there were eighty-three English sparrows, forty-nine catbirds, thirty-seven brown thrashers, twenty-eight house wrens, twenty-seven kingbirds, and twenty-six bluebirds.

It may be considered, then, that the following statements represent the approximate truth at the present time relative to the abundance of birds: (1) some birds have become extinct; (2) other birds are threatened with extinction; (3) the game-birds, wild fowl, shore-birds, and egrets have greatly decreased in numbers in recent years; (4) hawks and owls have decreased to some extent; (5) song-birds have

decreased in the neighborhood of cities; (6) in the country there has been no appreciable change in the numbers of song-birds; (7) the numbers of these birds could be considerably increased with advantage to man without disturbing nature's balance.

CHAPTER XIII

THE NATURAL ENEMIES OF BIRDS

THE facts presented in the preceding chapter naturally lead one to inquire what are the forces that have caused the great decrease of some birds, and that are holding our song-birds in check and preventing their increase. In the report by Mr. Forbush to which reference has already been made statistics were gathered regarding the causes of the decrease of birds.

The following is taken from his report for the State of Massachusetts, with a few of the minor causes omitted: —

MAN THE EXTERMINATOR

The reports on the diminution of bird life, as caused directly or indirectly by man, may be tabulated as follows to show the relative importance of each cause: —

Cause	*Number of observers reporting (out of 217)*
Sportsmen, or (so-called "sportsmen")	82
Italians and other foreigners	70
Cutting off timber and shrubbery	62
Market hunters	57
Bird shooters and trappers	32
Egg collectors, boys and others	32
Milliners' hunters	18
Draining marshes and meadows	17
Gun clubs and hunting contests	16

The natural enemies of birds, noted as harmful by the observers who have contributed to this portion of the report, may be arranged in the following order, with reference to the number reporting each: —

Natural enemy	*Number of observers reporting*
Cats	82
Foxes	58
Crows	54
Squirrels	42
English sparrows	39
Hawks	34
Jays	26
Owls	22
The elements	21
Weasels	17

The enemies of birds may be arranged as follows with special reference to the part that man has played in their destruction: —

I. Natural enemies.
  1. Four-footed enemies.
    A. Squirrels.
    B. Foxes, weasels, etc.
  2. Feathered enemies.
    A. Crow, blue jay, crow blackbird.
    B. Hawks and owls.
  3. The elements.
II. Man as an enemy.
  1. Agencies for which man is indirectly responsible.
    A. The cat.
    B. The English sparrow.
  2. Agencies for which man is directly responsible.
    A. Unavoidable destruction.
      a. Cutting off timber and shrubbery.
      b. Draining marshes.
      c. Lighthouses.
      d. Wires (telegraph, telephone, trolley, electric lighting).

B. Needless destruction.
  a. Shooting for sport.
  b. Market hunters.
  c. Milliners' hunters.
  d. Egg-collecting.
  e. Shooting song-birds for food.

Among the agencies destructive to bird life are natural enemies which were operative before the advent of the white man, and most of which are still in existence, although many have been destroyed by man.

Squirrels. Among the squirrels the red squirrel is one of the worst offenders. When it is common, it is a serious enemy of small birds. It eats both eggs and young birds. It is able to reach almost any bird's nest and the small birds can do little to protect themselves from it. When the red squirrels are present in excessive numbers, it may be necessary to reduce their numbers to protect the birds. The gray squirrel and chipmunk occasionally feed on young birds, but not so commonly as does the red squirrel.

Other four-footed enemies. Other animals that may at times destroy eggs and young birds are foxes, weasels, minks, and skunks. Probably none of these, except when numerous, is to be considered a serious enemy of the song-birds. As these animals are rare throughout many portions of the United States, they do not usually do much damage.

Feathered enemies. There is strong evidence that the crow, blue jay, and crow blackbird at times do much damage, especially the crow, in destroying eggs and the young of small birds. These birds have been repeatedly observed to attack the nests of other birds, and some students consider the crow the worst natural enemy of small birds.

An examination of eleven hundred stomachs of crows, made by the Bureau of Biological Survey, showed that fifty, or about five per cent, had fed on wild birds or their eggs. In the same bulletin is the following reference to the egg-eating habit of the blue jay: "As this trait of the jay appears to be most pronounced during its own breeding season, it is quite possible for many birds which have suffered from his boldness early in the season to raise another brood unmolested." This egg-destroying habit is probably not true of all crows and jays, but is limited to a certain number of individuals.

Among the hawks are found some of the worst natural enemies of birds, the chief offenders being the pigeon hawk, Cooper's hawk, and sharp-shinned hawk. They attack the adult birds, and our small insectivorous birds make up over half of the food of the sharp-shinned hawk.

The owls occasionally feed on small birds, but not nearly so frequently as hawks. They are not to be considered serious enemies of the small birds. Shrikes feed to some extent on small birds, which

comprise about one fourth of their food. Among these, however, are included a good many English sparrows.

The elements. Birds which spend the winter in the northern United States may suffer severely from the extreme cold and from lack of food on account of the deep snows and the coating of ice on trees that cover their food-supply. Many birds perish every severe winter. The lack of food is one of the chief reasons for this mortality. With plenty of food birds can withstand very low temperatures, but when they are only half fed, they easily succumb to the cold.

Mortality during winter. In Massachusetts, Mr. Forbush made a study of this matter during the winter of 1903 to 1904 from reports received from seventy-five correspondents. These reports showed that during the first half of the winter, birds were present in about their usual number, but as the severity of the weather increased, the number of birds began to decrease, till by the end of the winter a very noticeable mortality was universally reported, and many birds were found dying of cold and hunger; and it was the opinion of those best fitted to judge that most of the birds which usually wintered there were either starved or frozen.

Among the greatest sufferers were the bob-white, ruffed grouse, meadowlark, and flicker. In some localities the bob-white was apparently entirely

exterminated, Mr. Forbush estimating that it had been reduced at least ninety-five per cent.

During the winter of 1911–12, which was exceptionally severe, many reports received from portions of the northeastern United States indicated that many birds perished. The sleet and snow covered their food so that the birds fell easy victims to the low temperatures. Water-fowl perished by the thousands on the Delaware River. In Iowa it was estimated that seventy-five per cent of the bob-whites and prairie chickens perished. In New Jersey it was reported that grouse and quail were dying from hunger on account of a coating of ice beneath the snow, through which the birds could not dig holes for food. Similar reports came from Kansas. The marshes and coves by the sea, where water-birds usually stay, froze so that the birds were not able to secure food.

In the late winter of 1895, bluebirds were overtaken by a spell of cold weather in the South, as a result of which thousands perished. The diminished number of bluebirds was very noticeable for many years afterward.

Mortality during spring. Dr. T. S. Roberts reports in "The Auk" a Lapland longspur tragedy that occurred in southern Minnesota and northern Iowa in March, 1904. Apparently a great host of these birds were migrating to their northern home on the night in question, when they were over-

taken by a snowstorm, and, becoming confused by the darkness and snow, some were attracted by the lights of the towns, where they dashed themselves to the ground and against the buildings and perished in enormous numbers. Many others, laden with the heavy, wet snow, were evidently unable to continue their flight and fell to the earth, where they were stunned or killed. The next morning the ground was strewn with dead birds. On two lakes of an area of about two square miles, it was estimated that a million birds had perished. The total area in which this tragedy occurred was about fifteen hundred square miles. If in two square miles a million birds perished, it is difficult to imagine what the destruction must have been throughout the whole area.

Unseasonable storms, especially cold rains in the spring, destroy a great many birds. The early migrants are the birds most apt to be affected by these storms.

During the nesting-period, prolonged seasons of cold, rainy weather may render it difficult for the birds to find food either for themselves or their young, and the young may be chilled in the nest. In 1903 the numbers of martins were reduced very noticeably by this means in some sections of the country. In portions of New England they were almost wiped out.

CHAPTER XIV

BIRD ENEMIES INTRODUCED BY MAN: THE CAT AND THE ENGLISH SPARROW

Coming now to the part that man has played in the destruction of bird life, we will first consider those agencies for which he is indirectly responsible, namely, the cat and the English sparrow. The cat was brought to this country as a pet by the white man, and is now often so poorly fed and cared for, and even entirely deserted by people, that man must be held largely accountable for the harm that cats do. In a similar way man is responsible for the English sparrow, because it was introduced by him into this country in 1851 and at later dates, and has now become one of the worst enemies of certain song-birds.

The Cat

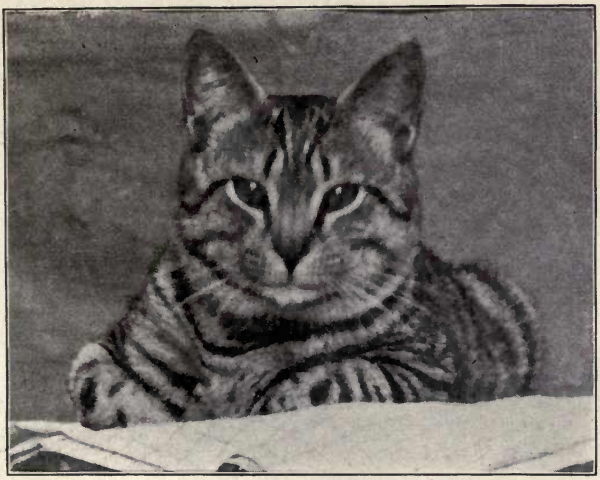
Method of doing harm. There is quite general agreement among bird-students that cats are the worst enemy of the song-birds. The chief harm is done during the nesting-season. While the young are in the nest, they are entirely helpless and unable to defend themselves against the cat. Not only does the cat find nests on the ground, but it can

easily climb trees and reach the nests there, so that there are few places where birds build their nests that are not accessible to the cat. And even after the young leave the nest, many are caught when learning to fly. Cats destroy also a great many adult birds. When the parent birds are defending their young against the attacks of the cat, they often come within reach of the cat's paws; and even when birds are feeding on the ground, they may be pounced upon by cats that are lurking near, hidden in some shrub or tuft of grass. And again, when birds are bathing, they are not able to fly and so may be easily caught.

It seems to be a nearly universal instinct among cats to delight in catching birds. Even when cats are not hungry, they catch more birds than they can eat, torturing them in the most sickening fashion. Mr. Neil W. Ladd, of Greenwich, Connecticut, reports that his household Angora cat, though loaded with bells, brought to their veranda thirty-two birds during one nesting-season and twenty-eight birds during the next season, none of which it ate.

The cat at best is only partially domesticated, and, when deserted, as is so often the case by thoughtless people, it runs wild and lives almost entirely on birds during the season when they can be obtained. There are many thousands of these stray, vagrant cats thus devastating our bird life, aided

CAT WITH ROBIN



A CAT THAT DOES NOT KILL BIRDS

He is kept in or caged during the night, fed regularly, and given a good breakfast before his morning liberty

by many other thousands of pet cats, which hunt birds, not so much from hunger as from a natural instinct to kill birds.

Most people do not realize the harm done by cats because they work quietly, on the sly, chiefly in the early morning, before most people have arisen. Mr. Forbush's investigations showed that about ninety per cent of the cats are allowed to roam at night. At earliest daybreak they attack the young birds in the nest, frequently killing also the mother bird on the nest. And then, too, the nests which the cats attack are frequently so well hidden that a person who is not specially watching does not see the tragedies that are being enacted there.

The control of the cat, as one of the chief enemies, if not the chief enemy, of bird life, is one of the pressing questions to be solved by those interested in bird-protection. In order that the harm done by cats may be more generally appreciated, below is given a list of quotations from a number of bird-students. These quotations will suffice to show that the views expressed in these pages are not simply those of the author alone: —

The most important problem confronting bird protectors to-day is the devising of a proper means for the disposition of the surplus cat population of this country. (Frank M. Chapman, Curator of Birds in the American Museum of Natural History and author of several well-known bird books.)

The cat is more dangerous to birds than is any native mammal that roams our woods, for it is nocturnal, a splendid climber, a good stalker, a strong leaper, and is very quick and active. (E. H. Forbush, State Ornithologist of Massachusetts.)

There is no wild bird or animal in the United States whose destructive inroads on our bird population are in any sense comparable to the widespread devastation created by the domestic cat. (T. Gilbert Pearson, secretary of the National Association of Audubon Societies.)

The cat is acknowledged to be one of the most destructive of all the bird enemies and is, therefore, an expensive luxury. If crops are worth money, the birds that save them from pest destruction are worth money, and the cat takes money out of your pocket every time it catches a bird. As birds decrease in numbers, insect pests increase and eat our crops, plants and trees. (Charles H. Pease, secretary of the Connecticut Commission of Fisheries and Game.)

Field naturalists and others who have studied conditions surrounding our native birds, agree that the house cat is as destructive to birds as all other natural enemies combined. (A. K. Fisher, of the Bureau of Biological Survey.)

Taking into account bird life in general, the cat is undoubtedly the most destructive mammal we have, and the aggregate number of birds annually killed by them is enormous. (Henry W. Henshaw, chief of the United States Bureau of Biological Survey.)

In such thickly settled communities as our northern States, from the Atlantic Coast to the sandhills of Kansas and Nebraska, the domestic cat is probably the greatest four-footed scourge of bird life. That cats destroy annually in the United States several millions of very valuable birds, seems fairly beyond question. (William T. Hornaday, Director of New York Zoölogical Park.)

John Burroughs says that cats destroy more birds than all other animals combined.

William Dutcher, president of the National Association of Audubon Societies, considers the wild house cat one of the greatest causes of bird destruction known.

Mr. E. H. Forbush found that nearly a hundred correspondents scattered through all the counties of Massachusetts reported the cat as one of the greatest enemies of birds, a larger number reporting this than any other enemy.

M. Raspail in France watched sixty-seven nests for one season and found that forty-one of these were destroyed. Fifteen of these were robbed by cats, which destroyed more nests than any other single enemy.

The destruction of birds by cats means a direct economic money loss. It means an increase of insect pests. This increase means more destruction of crops, which means smaller yields and smaller financial returns: more cats — fewer birds — more insects — smaller crops — less money.

Number of birds killed by cats. There are enough data available so that one may secure an approximate estimate of the number of birds killed by cats in a year.

Mr. A. C. Dyke reports a pet cat that was well fed, which was actually seen to kill fifty-eight birds in one season, including the young in five nests.

Mr. E. H. Forbush estimates that a mature cat in good hunting-grounds kills, on the average, fifty birds a year. He saw a cat kill all the young in six nests and two parent birds in a day. He also reports two instances where more than ten birds were killed by a cat in one day, and another where seven were killed.

In "Bird-Lore" for March–April, 1915, and in a bulletin on the "Domestic Cat," Mr. Forbush gives some interesting results of his investigations regarding the cat. A series of questions was sent out to a number of people in Massachusetts, and answers received from more than four hundred. These showed that one hundred and seven species of birds killed by cats had been identified by the writers. Following is a partial list of the birds reported: —

Name of bird killed	*Number of observers reporting*
Robin	272
Bluebird	75
English sparrow	72
Chipping sparrow	54
Catbird	52
Ruffed grouse	46
Song sparrow	46
Bob-white	44
Barn swallow	42
Junco	34
Blue jay	25
Chickadee	24
Flicker	24
Yellow warbler	20
House wren	16
Meadowlark	14
Baltimore oriole	13
Hummingbird	10

Numerous correspondents had known individual cats to kill from two to eight birds in a day, though the average was much smaller. In several cases cats were known to kill almost or more than fifty birds in a year.

The reports showed that —

226 cats killed 624 birds in one day, an average per day of		2.7.
32 cats killed 239 birds in one week, an average per week of		7.9.
15 cats killed 307 birds in one month, an average per month of		20.4.
47 cats killed 534 birds in one year, an average per year of		11.3.

The average for the year is small because few persons kept careful account of the birds killed during a whole year, while others, whose cats had been "taught not to kill birds," reported that their cats had killed only one, two, or three birds in a year.

If we assume that these cats continued to kill birds at the same rate for one month and average them all, taking into account the number of cats in each group, the average for a month is 62. If we give the four groups equal consideration, regardless of the number in each group, the average number killed is 33. The average of the third group alone, comprising 15 cats, is 20.4. And if finally we average these three averages, the result is 38. In order to make a conservative estimate, we will take the lowest of the four averages, 20.4 as the average number of birds killed in a month by one cat. It is fair to assume that a cat would continue to kill birds at this rate during at least one month

in the height of the nesting-season, when young birds are easily caught, and when most of the harm is done.

Number of birds killed by cats in Massachusetts. These investigations of Mr. Forbush give data for forming some estimate of the total number of birds killed each year by cats in the State of Massachusetts. It was found that an average of about one cat per family was kept in towns and nearly three cats per farm in the country, so that we may take two cats per farm as a fair average. There are in Massachusetts 37,000 farms supporting about 74-000 cats. As previously shown, the average number of birds killed by one cat during one month of the nesting-season was 20.4. This multiplied by 74,000 gives a total of 1,509,600 birds, probably mostly young birds, killed annually by cats on the farms of Massachusetts, or, in round numbers, one and a half millions.

We may next inquire what per cent of the total bird population this number comprises. In a bird-census conducted by the United States Bureau of Biological Survey, it was found that there was an average of one pair of nesting birds per acre on the farms of the northeastern United States. In Massachusetts there are about 2,800,000 acres of farmland, which, in accordance with the above census, support 2,800,000 pairs of birds. Assuming that each pair reared two young birds to at least partial

maturity would give a total of 5,600,000 young birds for the first brood. We may also estimate the second brood from the data furnished by the census, in accordance with which there would be in Massachusetts about

300,000 pairs of robins.
250,000 pairs of English sparrows.
78,000 pairs of house wrens.
72,000 pairs of bluebirds.

700,000 pairs in all.

Assuming again two young reared in the second brood gives a total of 1,400,000. This, added to the number of the first brood and to the number of adults, gives a total of 12,600,000 birds on the farms of Massachusetts. In accordance with the previous estimate that cats kill about one and a half millions, this would mean that they destroy annually about one eighth of the total bird population found on the farms of Massachusetts.

Mr. Forbush, in his bulletin on the "Domestic Cat," quotes the following estimates: —

Dr. George W. Field, chairman of the Massachusetts Commission on Fisheries and Game, estimates that there is at least one stray cat to every hundred acres in the State, and that each cat kills on the average at least one bird every ten days through the season, making the annual destruction of birds by stray cats in the State approximate 2,000,000.

Dr. A. K. Fisher, in charge of Economic Investiga-

tions of the Biological Survey, estimates that the cats of New York State destroy 3,500,000 birds annually.

Mr. Albert H. Pratt calculates that the farm cats of Illinois kill about 2,500,000 annually.

Number of birds killed by cats in the eastern United States. The average of these estimates for the three States is about one hundred birds killed per square mile. If this average is applied to all the States east of the Mississippi River, it would give a total of 85,000,000 birds killed annually by cats in the eastern United States.

We may also make a rough estimate from the number of farms and families in the country. There are in the United States east of the Mississippi River 3,800,000 farms. If we take the conditions in Massachusetts as being typical of the rest of the country in averaging two cats to a farm, these farms support 7,600,000 cats. On the farm, where there are excellent hunting-grounds for the cat, it is a very conservative estimate that each cat averages to kill ten birds in a year, making a total of 76,000,000 birds killed annually by cats on the farms of the eastern United States.

An estimate may also be made of the number of birds killed by town cats. According to the census of 1910, the urban population of the United States east of the Mississippi River, living in towns and cities of twenty-five hundred and over, was 33,500,000, comprising about 7,400,000 families. The

cats kept by families living in the more crowded portions of the large cities can do little harm to native birds, because few birds are present. In 1910 there were east of the Mississippi River 37 cities having a population of over one hundred thousand, making a total of 16,700,000, comprising about 3,700,000 families. Subtracting this number from the total number of families given above leaves 3,700,000 families living in towns and cities where cats might find birds to kill. The number of families living in the centers of cities with a population of less than one hundred thousand, where few birds are found, would be about balanced by the number of families living in the suburbs of the large cities where birds are found.

At the last census there were about one million families east of the Mississippi River living in incorporated places of less than twenty-five hundred. This added to the previous number gives 4,700,000 families living in the towns and smaller cities where birds are found quite commonly.

Mr. Forbush's investigations in Massachusetts showed that in the towns the average number of cats per family was about one. Allowing one cat per family throughout the country would give a total of 4,700,000 cats kept by these families. If we assume that the farm cat in good hunting-grounds kills ten birds a year, we may assume that the town cat, under less favorable conditions, aver-

ages to kill five birds annually. This would give a total of 23,500,000 birds killed by these town cats. This added to the number destroyed by farm cats gives a total of 99,500,000, or about one hundred million birds killed annually by cats in the United States east of the Mississippi River.

An estimate may be made of the percentage that this forms of the total bird population. A census taken of the birds on the farms in the United States showed that there was an average of one pair to the acre, making a total of about seven hundred million birds east of the Mississippi River. If we assume that each pair rears to at least partial maturity two young birds, there would be approximately a billion and a half birds in this area, of which number, in accordance with the above estimate, about one fifteenth are destroyed by cats.

The above estimate does not take into account the numerous stray and homeless cats, which in the country doubtless may number as many as the pet farm cats and may do fully as much harm. Mr. Chapman says that there are not less than twenty-five million cats in the United States and that there may be double that number.

Cats as disease-carriers. One of the reasons why cats are kept is to serve as pets. But even here their value is doubtful, as it has been proved that cats occasionally act as disease-carriers. Sometimes they have the disease themselves and then carry

it directly to human beings; in other cases they simply carry on their fur the disease germs which are taken from infected sources. The scavenging habits of cats in filthy places are well known. While seeking food in these places and while rolling in the dirt, their fur takes up the bacteria-laden dirt, and these bacteria may then be transferred to children and others who fondle the cat.

A few years ago Dr. Caroline A. Osborne made a careful investigation of the evidence at hand relating to the part that cats play in carrying diseases. The results of her investigations were published in the "Chicago Medical Record." In accordance with the evidence there presented, it seems established that cats are subject to the following diseases which are also found in man: tuberculosis, diphtheria, bubonic plague, whooping-cough, anthrax, ringworm, mange, tapeworm, trachina, glanders, sleeping-sickness, pulmonary distomatosis, and Asiatic liver fluke. Evidence is also presented which indicates that the cat has been known to carry the following diseases to human beings, either mechanically on its fur or through having the disease itself: diphtheria, bubonic plague, scarlet fever, smallpox, ringworm, and mange. Rats are a source of danger as disease-carriers, and it is shown that cats through contact with rats have been known to carry bubonic plague and diphtheria to human beings.

Mr. Forbush in his investigations in Massachu-

setts gathered evidence regarding the part that cats play in the transmission of diseases. After consultation with medical authorities, he reached the conclusion that most of the data he had gathered furnished only circumstantial evidence and were inconclusive. But he concludes that the evidence shows that "cats undoubtedly disseminate ringworm and rabies, and they may carry such infections as smallpox and scarlet fever; and in some cases serious infections appear to have been transmitted by the bites or scratches of cats."

The evidence at hand proves conclusively that cats have sometimes been the means of transmitting diseases to human beings. To determine exactly what kinds of diseases and how frequently they may be transmitted to human beings requires further investigations.

Remedies. Bird-students are quite generally agreed that a partial solution of the cat problem lies in licensing cats. Owners of cats should be required to pay an annual license, such as is now required for dogs. This licensing would tend to reduce the number of cats, as people who now keep several cats would then keep but one, and some people would not keep any at all, and the cats that were kept would be better cared for. Such a cat license is required in St. Petersburg, Florida. The town of Montclair, New Jersey, has recently passed an ordinance to the effect that owners of cats shall

place marked tags or collars on their cats, and provisions are made for the humane disposal of any cats not thus marked.

This licensing should be accompanied by some plan by means of which unlicensed stray cats would be disposed of. The fee from the licenses might be used to employ some one to capture and kill in some humane way the vagrant cats. In Montclair an animal warden has been appointed to look after the enforcement of the cat and dog ordinances. The license fees have been sufficient to pay his salary. The destruction of these vagrant cats is a kindness to the cats, as during the colder months of the year they are not able to secure enough food and consequently live in a half-starved condition. In New York City alone, the Society for the Prevention of Cruelty to Animals killed, during 1915, 175,000 sick, injured, and homeless cats. The matter of disposing of stray cats concerns the cat-lover quite as much as the bird-lover.

Little can be done in training cats to let birds alone. It is the exceptional cat that can be thus trained. Belling the cat is another method of little value. During the nesting-season of birds cats should be shut up, especially at night and during the early morning, and at all times should be well fed so that they will not have hunger added to their natural instinct as a stimulus to catch birds. The following note is contributed to "Bird-Lore" by

Cornelia T. Fairbanks, of St. Johnsbury, Vermont: —

> We have solved the question of how to control our family cat. His days are spent under the south piazza, where he sits contentedly looking out through the netting in front, or curls up in a box in a shady corner. After the birds are quiet for the night, he is released. The good supper that awaits him at nine o'clock never fails to bring him to the door, where he is captured and safely shut up for the night.

Another solution of the problem is to keep the cat tethered to an overhead wire during the birds' nesting-season.

As a matter of common decency no one has a right to keep a cat that becomes a nuisance in killing birds on his neighbor's place, any more than he has a right to keep cows and horses and allow them to roam at will over his neighbor's garden. Any one who wishes to attract birds around his home in any considerable numbers must dispose of the cats that trespass on his place, whether they be stray cats or neighbors' cats. These can be caught by means of cat-traps, a number of which are now in the market, for sale by some of the dealers listed in Chapter XIX. Nests and nesting-boxes may be protected from cats by wrapping a piece of tin or zinc, about eighteen inches wide, around the tree or post four feet from the ground, and fastening it there. Cats are not able to climb over this.

The cat is kept for two purposes, as a pet and as a mouser. As a pet it may be dangerous to health, and there are other pets that are equally or more desirable. As a means of controlling rats and mice, it is only moderately successful, and mice and rats can be more effectually controlled by means of traps and poisons. Mr. Forbush's investigations in Massachusetts seem to indicate that only about one fifth of the cats kept in country towns are efficient ratters. And when these pests are once cleaned out there is no need for keeping a cat.

Professor Nathaniel Southgate Shaler in his "Domesticated Animals," writes as follows of the cat: —

> The cat is the only animal that has been tolerated, esteemed, and, at times, worshiped, without having a single distinctly valuable quality. It is in a small way serviceable in keeping down the excessive development of small rodents, which from the beginning have been the self-invited guests of man. As it is in a certain indifferent way sympathetic, and by its caressing appears to indicate affection, it has awakened a measure of sympathy which it hardly deserves. I have been unable to find any authentic instances which go to show the existence in cats of any real love for their masters.

Mrs. Alice H. Walter, in "Bird-Lore" for January–February, 1915, summarizes the matter in the following list of questions: —

> Every person is free to his or her own opinion, but conscientious answers to the following questions may help some who are not decided as to the merits of this question to make up their minds definitely: —

1. Am I harboring a cat which may be a disease-carrier?
2. Does my cat trespass on the grounds of other people and interfere with their plans for saving or attracting birds?
3. How many wild birds does my cat catch and bring to my notice every year?
4. Does my cat wander free at night, disturbing my neighbors by fighting with other cats or by making harassing noises?
5. Am I perfectly sure that my cat is a good mouser?
6. Am I sure that rats and mice about barns and houses cannot be more effectively destroyed by some other means than cats?
7. Am I justified in keeping cats which breed frequently and in letting their progeny go here, there, and everywhere?
8. Do I know how many stray cats are about my neighborhood?
9. Am I taking a broad-minded view of the cat question?

Any person who considers this matter in the light of the public welfare, instead of his own personal interests, is the right kind of citizen. Nowadays, we live in communities which are too thickly populated to warrant a superabundance of any animal, be it cat, dog, bird, or pig. Favor should be given to those creatures which are doing the most good and not to those which are doing the most harm.

The English Sparrow

Ways in which it is harmful. Perhaps the English sparrow ranks next to the cat as an enemy of certain birds which it most directly affects. The birds which it especially injures are those which seek similar nesting-sites, such as the wren, bluebird, martin, and tree swallow. These birds, like the sparrow,

all nest in cavities or nesting-boxes. The sparrows remain all the year round and begin to nest before the native birds have returned in the spring, so that when they do return, they frequently find their nesting-sites already occupied. And even when the native birds have found an unoccupied site, and have started to build their nests, the sparrows often come and attempt to drive them away, and as there are so many more of the sparrows than of the native species they are usually successful.

The sparrows do not confine their persecution to birds that seek similar nesting-sites, but may attack other birds, such as the robin, vireo, and catbird, and cause them to desert the places where they are nesting. And the sparrows even attack the nests of cliff swallows, and drive barn swallows from the buildings where they are nesting. The sparrows even go farther than this and sometimes break the eggs and destroy young birds in the nests.

Professor Barrows gives a list of seventy-five species of our native birds which English sparrows have been reported to molest. The following table shows the number of times they were reported to have attacked certain birds: —

Bird attacked	*Number of different records of attacking*
Swallows and martins	440
Bluebird	377
Other sparrows	273
Wrens	191
Robin	182

One thing that makes the sparrows so troublesome is the large number of young that they raise each year. They begin nesting in late winter or early spring and may rear five or six broods, including from twenty to thirty young, in a season. It has been estimated that the offspring from a single pair of sparrows in ten years might number 275,000,000,000.

Remedies. Where bird-houses are put out to attract native birds, the sparrows usually attempt to occupy them, and must be driven away or killed if we wish to induce the native birds to nest there.

The sparrow may be kept from using boxes intended for smaller birds by making the hole so small that the sparrows cannot enter. The sparrow cannot enter a one-and-one-eighth-inch hole, but this hole is large enough for the chickadee, and an inch hole is large enough for the wren.

Sparrows may be prevented from rearing their young in bird-boxes by removing their eggs every week or two during the nesting-season, and sometimes the sparrows will leave as a result; but the only satisfactory solution seems to be to kill the sparrows. This may be done in three ways: by shooting, by poisoning, and by trapping.

The enormous numbers of sparrows and the wide range over which they are found might at first seem to make any attempts at their destruction hopeless. But experiments in the destruction of these

birds have shown that flocks and individuals have a very narrow range, and confine their activities largely to one locality, so that when a place has once been freed of sparrows, some time passes before others come in. The following illustration of this is given in the Farmers' Bulletin No. 493, "The English Sparrow as a Pest": —

> This tendency to remain on a special territory was well shown during a recent experiment with a flock in a small garden. During the fall steady trapping reduced the resident flock in the garden to a dozen individuals, 274 birds having been trapped. The survivors were poisoned. Though another flock lived in the street just beyond the fence, the garden was sparrow-free for three months. In the following spring a few sparrows appeared, but were soon trapped. After this the garden continued throughout the summer without a resident flock, and only rarely was it visited by sparrows from other parts of the neighborhood.

Shooting the sparrows. There are a number of reports available which show that the sparrow can be controlled by systematic shooting. Mr. Newton Miller reports in "Bird-Lore" that for twenty-five years on his father's farm the sparrows were almost completely kept under control by shooting. Each spring from two to five pairs of sparrows came looking for nesting-sites, but when these were shot, the farm remained practically free from the pest for the rest of the year.

Mr. E. H. Baynes reports from Meriden, New

Hampshire, that the sparrows have been easily controlled by shooting. During the first season a warfare was kept up with two guns for a number of weeks till the sparrows that had not been shot left town. About once a year a flock of from twenty to thirty sparrows comes to Meriden from the surrounding villages, but these are quickly disposed of, or driven away by a few days' shooting.

Mr. E. H. Forbush reports that his farm has been kept clear of sparrows for ten years by the practice of shooting promptly the first one that appeared.

Mr. Neil M. Ladd gives the following suggestions in the first annual report of the Greenwich Bird Protective Society:—

> Shooting accomplishes great results when done as follows: Feed small grains from a small narrow trough on the ground for several days until hundreds of sparrows from the surrounding neighborhood flock to it the moment the food is put out. A shotgun so placed as to sweep the length of the trough will kill dozens at each shot. The gun can easily be secured in place and the trigger released by a long string.

In this connection the question has been raised whether shooting would not drive away other birds. But the records which the author has been able to obtain, together with his own experience, indicate that this fear is groundless.

Poisoning the sparrows. During the winter sparrows may be poisoned if care is taken to see that no other birds eat the poisoned food. In the Farmers'

Bulletin No. 493, on "The English Sparrow as a Pest," the following directions are given for the preparation of poisoned grain: —

Put one eighth ounce of pulverized strychnine sulphate into three fourths of a gill of hot water, add one and one-half teaspoonfuls of starch or wheat flour, moistened with a few drops of cold water, and heat, stirring constantly till the mixture thickens. Pour the hot poisoned starch over one quart of wheat and stir till every kernel is coated. Small-kerneled wheat sold as poultry food, if reasonably clean, is preferable to first-quality grain, being cheaper and more easily eaten by the sparrows. A two-quart glass fruit jar is a good vessel to mix in, as it is easily shaken and allows the condition of the contents to be seen. If the coated wheat be spread thinly on a hard, flat surface, it will be dry enough for use in a short time. It should be dried thoroughly if it is to be put into jars and kept for future use.

The following method of using poisoned grain is given by Dr. Hodge in "Nature-Study and Life": —

It requires but one kernel to kill a sparrow. A quart of wheat contains about 23,000 kernels, and the sparrows seldom take more than two or three. Expose the grain where poultry and tame pigeons cannot get it, and by operating only during the winter, there will be no danger of poisoning seed-eating wild birds at least for all Northern towns and cities. By taking advantage of the sparrows' gregarious habits, and the fact that they drive off other birds from localities where they are numerous, much might be done even in the South.

Sparrows are such suspicious and cunning birds that, if the strychninized grain be exposed at first, they will probably roll each kernel in their bills, taste it, reject it,

and possibly refuse to touch it again that winter. The best way is to select a place where the wind is not likely to scatter it away, — a walk, a driveway, or porch-roof with a smooth surface, — so that the grain may be swept up after each trial. Accustom them to feeding there daily with grain exactly like that which is medicated. (I often do this for a week, or even a month, until all the sparrows in the neighborhood are wont to come regularly.) Study the times when they come for their meals, and then on a cold, dry morning, after a heavy snowstorm, having swept up all the good grain the morning before, wait till they have gathered and then put enough strychninized grain to feed the whole flock. You have about ten minutes before any begin to drop, and those that have not partaken of the grain by this time will probably be frightened off: but by timing it properly I have repeatedly caught every sparrow in the flock. I have found morning the best time, as they all come then; and it is essential to success to select a dry day, since in wet weather they taste the strychnine too easily; I have seen them actually throw it out of the crop.

With this simple method at command, by concerted action, a few friends of our native birds can rid any Northern city of the sparrow pest in a single winter. This is no more than parents ought to do for the sake of the native birds, and if not for their sake, at least to clear the way for the children to do effective work in their behalf.

That sparrows can be kept in check by systematic poisoning is shown by the experience of Mr. Frank Bond while a resident of Cheyenne, Wyoming. Each winter a campaign was waged and the numbers of the sparrows were so reduced that they did not interfere with the breeding of the native birds, which

increased greatly in numbers with the growth of trees and parks, and the mountain bluebirds and house finch were common occupants of bird-houses. At the close of the winter's work there were never left more than thirty or forty sparrows, and sometimes even fewer.

When using the poisoned grain, after some of the birds have been killed, other birds will be frightened away, so that after each killing unpoisoned grain should be fed till the birds become accustomed to feeding there. Then the poisoned grain may be used again.

Trapping the sparrows. Trapping is one of the most satisfactory methods of killing the sparrows, and in some localities it is the only method that can be used. It is a safer method than shooting or poisoning, and may be used in cities where the other methods would not be allowed. Sparrows caught in this way may be used for food, if desired, and if native birds are caught they can be set free. In using poisons and traps special care should be taken to see that our native birds are not killed by mistake.

The combined use of traps and poisons is very effective. The trap may first be used to catch as many of the flock as will enter it and then poison may be used to kill the remainder.

At least two types of traps may be used for catching sparrows, the nest-box trap and the bait trap. The nest-box trap is so arranged that when the

bird enters, its weight pushes down a pivoted can and the bird drops down into the bottom, where it is imprisoned and may be easily removed and killed.

In Farmers' Bulletin No. 493 is described a bait trap. This is a kind of funnel trap made of woven-wire poultry netting. It consists of four parts: (1) a half-funnel leading into (2) an antechamber, which ends in (3) a complete funnel leading into (4) a final chamber. Canary seed, hemp seed, wheat, oats, and bread-crumbs may be used for bait. These are scattered in the antechamber and a little about the entrance. A live sparrow may be kept in the trap as a decoy. The trap will prove more effective if it is moved daily from one feeding-place to another. The sparrows are removed from the trap by means of a small receiving-box which is placed against a small door leading out of the final chamber. The sparrows may be easily drowned by placing in a bag and immersing in a pail of water.

These traps have been widely used with much success. Average catches of ten or twenty birds a day are reported, and an occasional catch of one hundred in a day. The bulletin mentioned above reports a catch of three hundred in six weeks. One man reports a catch of six thousand sparrows in four years through the use of traps. These traps may be purchased from a number of dealers listed in Chapter XIX, at prices ranging from three to six dollars.

CHAPTER XV

MAN AS AN ENEMY OF BIRDS

THIS chapter will be devoted to a discussion of the part that man has played directly in the destruction of birds. Some of the ways in which bird life has been destroyed are due to settlement and the general advance of civilization, and these are unavoidable.

Advance of civilization. With the rapid increase in population in the cities and towns, and their corresponding growth countryward, roadside shrubbery, orchards, decaying trees, and other nesting-sites are steadily disappearing. In the suburbs of cities birds that nest in cavities, such as the bluebird and wren, experience difficulty in finding nesting-sites. In the country sometimes the farmer thinks he must clear up the shrubbery and the tangles by the roadside and along the fences, which, however, furnish one excellent means of inducing the birds to remain and nest.

The breeding-places of many water-birds are being destroyed by the drainage of swamps and marshes. Not only is this true in the growth of towns and cities as their limits are broadened, but large areas are being drained for agricultural purposes to reclaim waste land. Throughout the north

central part of the United States are many small marshes which are being tiled and reclaimed by the farmer.

During migration seasons many birds lose their lives by dashing against lighthouses that happen to be in their path. This has been especially observed along the Atlantic Coast. It was reported that at the base of the statue of Liberty in New York Harbor there were found one morning fourteen hundred dead birds which had been killed during the night.

And finally man has played a very prominent part directly in bird-destruction by intentionally and deliberately killing birds; and this forms one of the saddest stories in connection with bird life, sad from the standpoint of birds on account of the harm that has been done them, and sad from the standpoint of mankind, as indicating the savage spirit which still pervades "civilized" man. All other forces combined are mere trifles compared with the part that man has played in the extermination of bird life.

Shooting for sport. Every year a vast army of men and boys, equipped with modern weapons, goes to the woods, fields, and lakes to slaughter birds. Mr. H. W. Henshaw, chief of the United States Biological Survey, writes that more than ten per cent of all people in the Northwest are licensed hunters, and that there are probably not far from five millions

in the United States who are interested in the pursuit of game. In the year 1911, hunting licenses were issued to 2,642,000 gunners in the United States. Besides these there is another great army of gunners who hunt contrary to law and without licenses, which is believed to be equally as large as the number of licensed hunters. This makes five million gunners, an army comparable to those engaged in the great European conflict. And this vast horde, averaging about one person to every three voters, marches forth each year for the "sport of killing," deliberately bent on destroying bird life. There is little wonder that our game-birds are fast disappearing.

The improvements that have been made in firearms render shooting much more deadly than formerly to bird life. The pump and automatic guns are really machine guns which allow five or six shots to be fired in as many seconds. The annual output of these guns is over one hundred thousand.

It is easy to understand that the annual slaughter by gunners armed with such weapons is enormous. A few examples will be given to show what devastation is possible with these modern weapons, which give the birds little if any chance of escape.

On Marsh Island, Louisiana, one man killed 369 ducks in one day and another market hunter killed 430. Two hunters in California killed 218 geese in one hour and 450 in one day. One case is recorded

where a man, armed with several pump guns and assisted by a man to keep them loaded, hid in a blind, and killed over one hundred ducks in less than two hours. By means of these guns a hunter may kill seven or eight birds out of a flock.

The term "game hog" has been aptly applied to this type of man who kills without limit, merely for the sport of killing. Most States have a "bag-limit" on game which defines the largest number of birds a person may take in one day, but the limit is usually so high as to furnish insufficient protection.

Railroads have been built through hunting-grounds hitherto inaccessible. The use of automobiles and motor-boats allows gunners to travel over five times as large an area as formerly and hence to do five times as much damage.

A form of gun that is now being used by men and boys to shoot song-birds is called the "Sunday gun." It is the combination of a rifle and shotgun, having two barrels. It is light and easily concealed under the coat. It derived its name on account of the use to which it is put. On Sundays boys and men start out with these weapons concealed under their coats, and when they reach the country spend the day shooting song-birds.

Hunting contests. In some parts of the country it has been the custom to have hunting contests. The men and boys of a community meet, armed with guns. Captains are selected and sides chosen. The

purpose of the day's hunt is to see which side can kill the most birds. The hunters scatter over the country shooting all living things, and, bringing in their game, meet again, and count up the points to see which side has the higher score. Each bird killed counts for a certain number of points.

Five hundred and sixty-five birds and other animals were killed in an annual "side" hunt at Enosburg Falls, Vermont, October 9, 1896. In a town in Vermont in which the author lived, a hunting contest was conducted on Thanksgiving Day; and after the hunt was over, the party went to a hotel and the side which had scored the highest count was treated to a Thanksgiving dinner by the losing side.

Most of the destruction to which reference has so far been made refers to the game-birds, but the small song-birds are also threatened by gunners, including boys, foreigners (mostly Italians), negroes, and poor whites in the South.

Shooting by boys. Rifles and other guns are often used by boys to shoot small birds. Sometimes there is a contest to see who can kill the greatest number. Mr. Forbush records a case in which one boy with his air rifle killed 470 song-birds, and some of his companions had killed more than this. One boy was found near Washington, D.C., with seventy-two kinglets alone, besides many other birds which had been killed in one day. During the season he had killed over one hundred catbirds. Boys sometimes

start out to kill English sparrows, but are not able to distinguish the different kinds of sparrows and so kill valuable native sparrows.

Shooting of song-birds by foreigners. In Italy any kind of song-bird is considered legitimate game, and when the Italians first come to this country they often begin to hunt our small song-birds. Mr. C. A. Johnson, of Hoosick Falls, New York, reports that two Italians recently confessed in court that they had boiled alive and then eaten young robins and flickers which they had taken from their nests. Wherever there are large construction works of railroads, aqueducts, etc., for which large numbers of Italians are employed, Sunday is apt to be a day of bird-slaughter. In Pennsylvania, six game-wardens were killed and eight or ten wounded while enforcing the law against foreigners.

Slaughter of robins in the South. In the South the song-birds are not so well protected as in the North, and many of them are shot for food. Robins were formerly killed in enormous numbers for this purpose. The robins roost together in large numbers and are easily killed at night by means of torches, clubs, and poles.

One small hamlet in the South sent 120,000 robins to market, where they were sold at five cents per dozen. In one section of Louisiana, where the robins came in the winter to feed on the holly berries, about ten thousand birds were slain daily as long

as the robins remained in the locality. An officer of the Louisiana Audubon Society estimates that one quarter-million robins are killed annually in that State for food purposes.

In 1911 there were eight Southern States in which robins were legally shot and eaten: Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Maryland, Texas, and Florida.

Shooting for market. Regarding the hunters who shoot to supply the markets, Dr. Hornaday writes, in "Our Vanishing Wild Life": —

> Beyond reasonable doubt, this awful traffic in dead game is responsible for at least three fourths of the slaughter that has reduced our game birds to a mere remnant of their former abundance. There is no influence so deadly to wild life as that of the market gunner who works six days a week, from sunrise till sunset, hunting and killing every game bird that he can reach with a choke-bore gun.

It has been estimated by careful observers that on the coast of North Carolina and in southern Louisiana, at least fifty per cent of the ducks that wintered there were formerly killed each year.

The following records of a professional market hunter have been published in a sportsman's magazine. During a three months' shoot in Iowa and Minnesota he shot 6250 game-birds. During a winter's hunting in the South he killed 4450 ducks. During his forty years' experience as a market hunter

he killed 4948 plover, 5066 snipe, 5291 quail, 5291 prairie chickens, 8117 useful blackbirds, 61,752 ducks, and many other birds, making a total of 139,628 birds representing twenty-nine species.

In the State of Nebraska nearly a half-million quail and grouse were formerly sold annually.

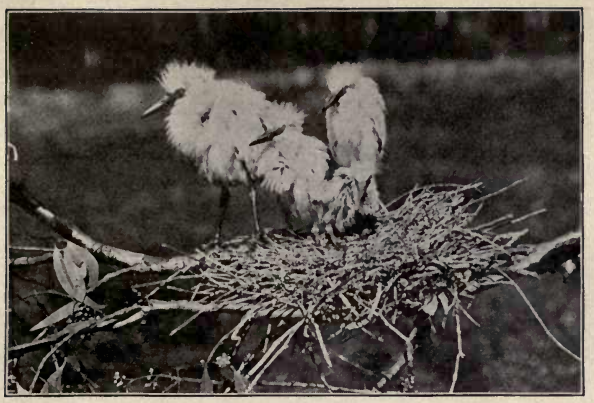
In the State of Alabama, before the present game laws were passed, nine million bob-whites were killed in one season.

In Georgetown, South Carolina, 240,000 rails and 720,000 bobolinks have been shipped in one season.

Below is the official record of game killed in Louisiana during the season (12 months) of 1909 and 1910: —

Wild ducks (sea and river)	3,176,000
Quail (bob-white)	1,140,750
Snipe, sandpiper, and plover	606,635
Doves	310,660
Coots	280,740
Geese and brant	202,210
Wild turkeys	2,219
Total number of game-birds killed	5,719,214

The milliners' trade. Formerly our common song-birds, such as scarlet tanagers, orioles, and blue-birds, were shot and sold for the milliners' trade. In 1886 Mr. Frank M. Chapman observed the feathered decorations on the hats of women he happened to meet in the shopping district of New York City for two afternoons. He found in common use such birds as robins, thrushes, blackbirds, tanagers, swallows, warblers, and waxwings. He also found



YOUNG EGRETS LEFT FATHERLESS AND MOTHERLESS BY PLUME-HUNTERS

RED SQUIRREL, A NEST-ROBBER

bobolinks, larks, orioles, and woodpeckers. He recognized the plumage of forty species of common song-birds. Out of seven hundred hats counted in one afternoon, five hundred and forty-two were decorated with feathers.

When the shooting of song-birds was more generally prohibited by law, some of the water-birds, such as the gulls, terns, and herons, were next slaughtered for this purpose. Between 1900 and 1908, thousands of grebes were slaughtered in the lake region of southern Oregon, till the birds were almost exterminated. The pursuit of these birds has continued until recent times, and when the shooting and sale of these were prohibited, birds were sought from other countries, till now the importation of plumes for milliners' use is prohibited by federal law.

Terns were formerly slaughtered along the coast of Long Island. One village alone supplied seventy thousand bird-skins in four months to the New York trade. Mr. Dutcher wrote: "On the coast of Long Island, the slaughter has been carried on to such a degree that, where, a few years since, thousands and thousands of terns were gracefully sailing over the surf-beaten shore and the wind-rippled bays, now one is rarely to be seen."

One dealer, during a three months' stay in North Carolina, prepared eleven thousand bird-skins. He handled about thirty thousand skins every year. One milliner visited Cobb's Island, on the coast

of Virginia, to fill a foreign order for forty thousand bird-skins. Men were hired to kill the terns and gulls found here and were paid ten cents for each bird killed.

Tragedy on Laysan Island. Six years ago a bird tragedy was enacted on Laysan Island, an American island in the Hawaiian group, in order to get plumes for the milliners' trade. Water-birds bred on this island in enormous numbers. A plume-hunter, accompanied by twenty-three Japanese laborers, sailed from Honolulu and made a raid on the island to kill the birds found there, for their feathers. For several months they remained here slaughtering the birds, when the United States Government learned of what was happening and sent a revenue cutter to stop them. When the captain arrived, he found that they had already killed about three hundred thousand birds and had about three carloads of wings, feathers, and skins. Nearly every bird on the island had been killed, and doubtless the remainder would have been had not the hunters been stopped in their butchery. Hundreds of birds were imprisoned in a dry cistern and allowed slowly to starve to death, because the skins from these birds were easier to prepare than those from birds killed while they were fat. There now comes another report that during the year 1915 another raid was made on Laysan Island, almost as destructive as the one mentioned above.

The egret. One of the most expensive plumes used in the milliners' trade is the aigrette, which sells at about forty dollars an ounce. Six birds are required to furnish an ounce of feathers. These plumes are borne by the bird only during the nesting-season, and the birds must be killed then to obtain them. The reports that they are picked up after being shed by the bird is absolutely untrue. The birds nest together in large numbers and so when once found are easily destroyed. The method by which the plumes are obtained is most sickening and horrible. The adult birds are shot and the plumes are stripped from their backs, often before the birds are dead. Thus the nestling birds, after the parents are killed, are left to die slowly of exposure and starvation. And in one case a still sadder chapter was added to this pitiful story. The Audubon Societies were making efforts to protect the few remaining colonies in the South and had appointed Mr. Guy Bradley as warden to guard these colonies, which were protected by the laws of the State. While doing his duty guarding this colony he was killed by plume-hunters.

Egg-collecting. The collecting of birds' eggs has been one cause of the decrease of birds. In former years large numbers of eggs of water-birds, which nested in large colonies, were collected along the Atlantic and Pacific Coasts and sold in the markets, but this is now almost entirely a thing of the past.

Another scourge of birds in some localities has been the boy egg-collector. Boys have a natural instinct for collecting, and unless taught better sometimes collect birds' eggs. These collections usually have no scientific value, the chief purpose of the collector being to see how many kinds of eggs he can find. Where there is rivalry among boys to see who can collect the most eggs, the results will be disastrous to the bird life of that locality. In most cases, probably, boys do not realize that the taking of eggs is forbidden by law. This kind of collecting is apparently now not so common as in former years. Sometimes professional collectors who have a license to collect may go to extremes in the number they secure.

Remedies. The remedy for excessive shooting for sport is to shorten the open seasons, reduce the bag-limit, and regulate the guns that may be used. In recent years there has been a great improvement along these lines in all the state laws.

The remedy for shooting for market and for feathers is to prohibit the selling of game and the use of feathers of wild birds for millinery purposes. In most of our States the sale of game is prohibited now, and in some the use of feathers, and the recent federal tariff regulation forbids the importation of feathers for millinery purposes. Thus, with reference to all kinds of shooting the outlook for the protection of birds is very hopeful.

The small boy who shoots birds and collects eggs must be reached through the schools, and with the introduction of nature-study into so many schools the value and protection of bird life are now being widely taught.

The problem presented by the shooting of song-birds by foreigners has been solved by several States by prohibiting aliens from hunting or from owning or possessing guns.

CHAPTER XVI

WORK OF THE AUDUBON SOCIETIES

THE preceding chapters have explained the work done by the army of destruction in slaughtering birds. The next few chapters will be devoted to the much pleasanter task of explaining the work done by the army of protection in trying to save our birds. This army is constantly growing larger and has been winning battle after battle of such decisive character that the outlook is now most promising that this army will soon be entirely victorious.

The first Audubon Society. The most active and effective agents in the cause of bird-protection are the Audubon Societies. The first society of this name was organized in 1886 by Dr. George B. Grinnell, editor of "Forest and Stream." As the result of an editorial written by Dr. Grinnell the idea of forming such a society met with a ready response and was endorsed by such men as Henry Ward Beecher, John G. Whittier, Henry C. Potter, and Oliver Wendell Holmes. By the end of the year, the Audubon Society had sixteen thousand members with over three hundred local secretaries scattered throughout the United States and in foreign countries. By August of the following year the membership had reached thirty-eight thousand.

In January, 1887, "Forest and Stream" started the publication of the "Audubon Magazine," to serve as the special organ of the Audubon Society. This contained articles of general interest on bird life. After being published for two years, the magazine was discontinued, and with it passed the first Audubon movement.

For a number of years the enemies of bird life again held sway and there was little organized effort in the interest of bird-protection. By 1895 the cause of bird-protection was at its lowest ebb.

The American Ornithologists' Union. The early history of the Audubon movement is closely bound up with the American Ornithologists' Union, an organization composed of the leading bird-students of the country. In 1884 a committee on bird-protection was appointed by the Union. This did very effective work in gathering statistics and publishing bulletins to arouse the public to the need of bird-protection. This committee worked in conjunction with the National Committee of Audubon Societies, and during one year the same man was chairman of both committees.

The second Audubon movement. In 1896 was begun the second Audubon movement, which has continued with constantly increasing momentum up to the present time. In that year state Audubon societies were organized in Massachusetts and Pennsylvania, and these were rapidly followed within the

next few years with organizations in other States, until now there are societies in thirty-seven States and in the District of Columbia.

The National Association of Audubon Societies. After these state societies were organized, it was felt that there should be a central national organization to bind the others together and direct their work. Accordingly, in 1902, a federation, known as the National Committee of Audubon Societies, was formed, composed of one member from each state society. The work of the committee grew rapidly and in 1905 led to the organization of the National Association of Audubon Societies for the Protection of Wild Birds and Animals. Besides being a medium of exchange between the several state societies, this association has taken on other functions, such as the formation of new societies, encouragement of proper legislation, promotion of educational work, and other lines of work, and it is to-day the mainstay and backbone of the whole Audubon movement. The objects of the organization are stated as follows in a circular issued by the Association: —

> The objects of the Association are to arouse in a greater degree the public conscience on the important subject of preserving wild birds and game animals of the country and to secure protection at all times for the valuable non-game bird life.

The credit for the initial success of this movement is due largely to the enthusiasm and untiring effort

of its president, Mr. William Dutcher, who since 1910 has been unable on account of sickness to take any active part in the work of the Association. Since that time the chief executive officer has been the secretary, Mr. T. Gilbert Pearson. Under his energetic management the Association has made remarkable growth, and many new lines of activity have been developed.

The following are the classes of membership in the Association: —

$5 annually pays a sustaining membership.

$100 paid at one time constitutes a life membership.

$1000 constitutes a person a patron.

$5000 constitutes a person a founder.

$25,000 constitutes a person a benefactor.

In 1915, there were 2558 sustaining members, 244 life members, 3 patrons, 1 founder, and 1 benefactor (deceased). The fees of the life members are added to the endowment fund. The total disbursements for the year 1915 were $93,000. The funds to meet these expenses are derived chiefly from three sources, the returns from the endowment fund, which now amounts to about $400,000, the dues of the sustaining members, and special contributions.

In the work for bird-protection many agencies have been active, but the National Association of Audubon Societies has been the prime mover which

has brought these agencies together to work in unison.

The work of the Association has been extended in many lines, chief of which are the following: (1) legislation, (2) warden work, (3) egret-protection, (4) publications, (5) junior Audubon classes, (6) field agents, (7) department of applied ornithology, (8) arranging for bird courses in summer schools, (9) establishing bird sanctuaries.

Legislation. The Association first gave its attention to securing proper laws protecting birds. The American Ornithologists' Union had prepared a model law for the protection of song-birds, and this was brought to the attention of legislatures in the various States, and efforts were made to secure its passage. These efforts have been almost uniformly successful and now this law has been adopted by forty States. Efforts were also made to secure better laws for the protection of game-birds, such as prohibiting spring shooting, shortening the open season, limiting the number of birds that may be shot, removing small birds from the game list, regulating the kind of weapons that may be used, and prohibiting the sale of game. Great progress has been made along all these lines.

When state legislatures are in session, all bills relating to bird life are carefully studied, and any bill that tends to remove protection from valuable birds is opposed, and bills that give birds more

protection are sanctioned. The Association has also been active in furthering national legislation.

Warden work. Many of the water-birds nest together in large colonies where thousands of birds nest within a small area. The Association employs about twenty-five wardens to guard these colonies during the breeding-season. The colonies which are thus protected are situated on the islands off the coast of Maine, along the coasts of New York, New Jersey, Virginia, Florida, and in the lakes of Michigan. It was estimated that during the season of 1913 about two million birds were protected in these colonies, and that during 1915 at least half a million young birds were brought to maturity.

Egret protection. For many years the Association has been endeavoring to save the egrets, whose extermination was threatened by the demands of the milliners. One of its wardens was shot while protecting colonies of these birds, and their numbers were reduced to such an extent that it seemed doubtful whether these beautiful birds could be saved, but persistent efforts have been made and the Association has raised a special egret fund to be used in protecting these birds, and the outlook is now very encouraging for their preservation. During 1915 the Association had seventeen special wardens protecting these egret colonies, which are located in Florida, South Carolina, and Missouri. During the season of 1915 these wardens had under their

care twenty distinct rookeries which contained about three thousand snowy herons and seven thousand egrets. In these rookeries many other water-birds are also protected, which were estimated in the season of 1914 to number about half a million.

Publications. One of the most important lines of work carried on by the Association is the issuing of its various publications for the education of the public on bird matters. First may be mentioned the magazine "Bird-Lore," which is the official organ of the Association. This was established in 1899 and stands to-day as the leading popular bird magazine in the country. The fact that Mr. Frank M. Chapman is editor is guaranty of the high standard of the magazine. This is published six times yearly, and is sent free to members of the Association. The price to others is one dollar.

Each issue contains two colored plates of birds, one of which is accompanied by a four-page insert descriptive of the bird's habits. The other picture is accompanied by a migration table based on the data furnished by the United States Bureau of Biological Survey. The magazine contains interesting articles by well-known bird-students, which are usually accompanied by photographs taken from life. There is a special school department for teachers and children, in which are given suggestions to teachers for teaching about birds, and to children on how to study birds; and opportunities are given for the

accounts of their observations to be published in "Bird-Lore." Brief notes are given of the work being done by the Audubon Societies, and in the November–December issue is given the annual report of the National Association. Reviews of books and magazine articles relating to birds are given. Volume 17, for 1915, contained 560 pages. The magazine is published at Harrisburg, Pennsylvania.

After the educational leaflets are published in "Bird-Lore," they are printed separately and sold for two cents each, including the four-page leaflet, the colored plate, and an outline drawing. Other special leaflets are issued from time to time. During the year 1914 nearly four million colored plates and educational leaflets were issued. About ninety leaflets have now been published, some of which have been bound together in book form.

The Association publishes annually over six million pages of literature devoted to bird-protection, and at the office in New York City twenty clerks are employed to look after its business. It has for sale nearly two hundred colored lantern-slides of birds. A very satisfactory field-glass for bird-study is offered for sale for six dollars. The Association acts as a purchasing agent for its members in securing anything wanted in the line of bird-study and Audubon work. A circular giving full details may be had on application to the Association at 1974 Broadway, New York City.

Junior Audubon classes. Perhaps the most important work the Association has been doing during the last few years is its effort to interest children in birds through the medium of the schools. For several years the following plan has been used: In the early spring circulars are sent to teachers, explaining the method of organizing junior Audubon classes. Each child who wishes to join pays ten cents as the annual dues. He receives in return ten educational leaflets with the colored plate and outline of some common bird, and a bird button with a small picture of a robin on it and the inscription "Audubon Society." If the club numbers ten members, "Bird-Lore" is sent free to the teacher for one year. The leaflets alone would ordinarily cost twenty cents, but the Association is able to sell them at the rate of one cent, because it has a special fund, contributed by a friend for carrying on this work. After the club is formed, it can meet as often as it wishes and carry out such programs as the teacher and children may devise. Later in the season a letter is sent to each leader of a junior class offering prizes for the best and most interesting photographs of junior Audubon classes, the photograph to be accompanied with a brief account of the work of the class.

This movement first started in the South in 1910 with ten thousand pupils enrolled, and since then the movement has grown steadily and spread all

over the United States. In 1915 there were 7723 classes, including 152,179 members; and in 1916, 9901 classes, including 205,138 members.

"Bird-Lore" for July–August, 1915, gives the photographs of the clubs to which the prizes were awarded, and the accompanying explanation sent by the teacher. The first prize was given to the West North Street School, Canton, Ohio. Following is the letter sent from this school: —

April [writes the teacher who conducts this vigorous class] was the "Month of Birds" at West North Street School. During the spring vacation wren and bluebird houses to the number of one hundred and thirty were placed in yards adjoining the homes of the members. These houses had been built by the older boys, each one making two, so that the girls also might enjoy the society of bird-families near their homes. For Bird-Month each schoolroom displayed pictures of birds. many were those sent with the leaflets, and painted by the pupils themselves. The halls were also decorated, each room taking a section and trying to outdo the others in the originality of their decorations.

Birds are studied in all departments of the school. The pupils in the upper grades used the pictures of the Educational Leaflets of this and former years in the lantern, and each one gave us a talk about his bird as it appeared on the screen. Monday morning is the most interesting time of all, as so many birds have been observed during the two preceding holidays, and every one is anxious to hear the new reports and to add new birds to their list. This led to our boys being invited to speak to the boys and girls in other buildings, and tell them why and how birds should be protected. This was re-

garded by them as a great compliment. They went out in twos, on the afternoon of Arbor Day, carrying with them a wren house and a bluebird house. It was a pleasing sight. We heard very flattering reports of their work, and we are certain they won many new friends for the birds, and had an enjoyable and instructive experience.

Field agents. During the year 1915 the Association employed six field agents who gave their time to lecturing, attending the sessions of legislatures to look after bird legislation, securing new members for the National Association, and in general promoting the interests of the Association and the cause for which it stands. Illustrated lectures are given to audiences of school-children, women's clubs, granges, and other organizations.

Department of Applied Ornithology. There has been recently organized a new department of the National Association, called the Department of Applied Ornithology, in charge of Mr. Herbert K. Job. The purpose of this department is to furnish information by means of lectures and bulletins on methods of attracting birds around homes and farms, and on methods of raising wild game-birds by artificial means. Two bulletins have so far been issued, one on the propagation of water-fowl and another on the propagation of upland game-birds.

Summer courses in bird-study. During the summer of 1915 courses in bird-study were given under the auspices of the National Association at

eight summer schools, six of which were in state universities.

Bird sanctuaries. The Association has been influential in establishing bird sanctuaries, either buying or leasing land at its own expense, or interesting others to do so. It originated the system of federal bird reservations and coöperates financially with the Government in protecting them. It contributes financially for feeding birds in winter, for protecting big game, and for prosecuting violators of the law.

Needs of the Association. The needs of the Association are set forth in a recent circular as follows: —

Needs. The National Association depends for its support upon the income from a small endowment, and the contributions of its members and friends.

The present income is totally inadequate to meet the urgent and tremendously growing demands for aid from all parts of the country.

Persons interested in the study or preservation of wild birds or animals from any standpoint are invited to unite with us in this great economic movement.

A contribution of five dollars or more pays the fee of a sustaining member for one year.

A gift of one hundred dollars constitutes the donor a life member.

All members receive the magazine "Bird-Lore" and the various publications of the Association as they appear.

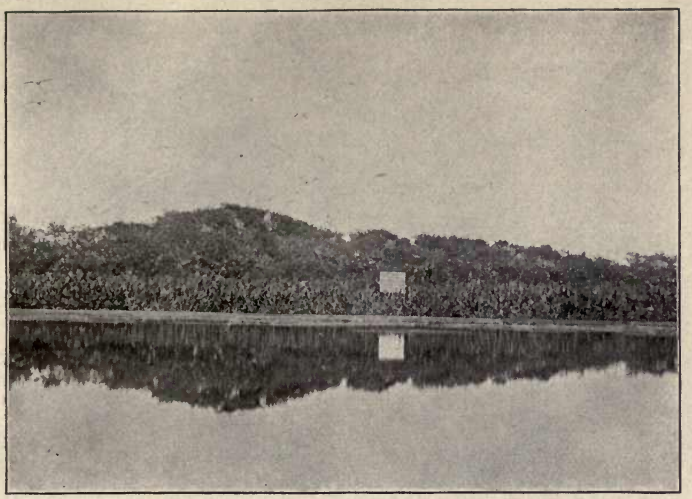
Application Blank

Being in sympathy with the objects of THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES FOR THE PROTECTION OF WILD BIRDS AND ANIMALS (incorporated), I hereby agree to become a SUSTAINING MEMBER, and enclose the sum of $5.00, the first annual fee.

Name.....
Street.....
City.....
State.....
Please mail to office of the Association,
1974 Broadway, New York City.
$100 paid at one time constitutes a life membership.

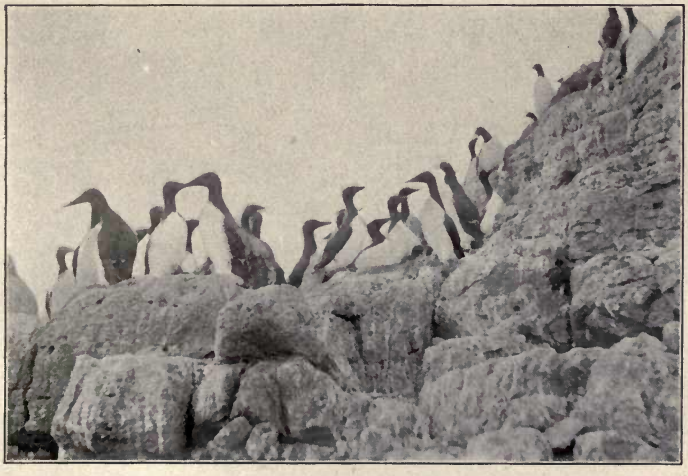
State societies. There are now state Audubon societies in thirty-seven States and in the District of Columbia. As an illustration of the work of these societies, a brief summary of the activities of the Massachusetts Audubon Society for the year 1914 is given. It had 225 life members and 2200 sustaining members. The Society occupies an office in Boston where exhibitions on various features of bird life are kept open to the public. During the winter it took steps to encourage the feeding of birds throughout the State. Junior Audubon classes were formed in coöperation with the National Association of Audubon Societies. A bird calendar is published each year and the Audubon bird charts are sold. It holds an annual meeting in the spring.

Birdcraft sanctuary. The Connecticut Audubon Society has recently created a bird sanctuary. This



BIRD ISLAND, FLORIDA

Reservation owned by the National Association of Audubon Societies



CALIFORNIA MURRES ON THREE ARCH ROCKS OFF THE OREGON COAST, ONE OF THE GOVERNMENT BIRD RESERVATIONS

consists of ten acres of land situated just outside the city of Fairfield. It has been surrounded by a cat-proof fence. Shrubs have been planted and nesting-boxes and winter feeding-devices installed. A small museum has been built, in which birds are displayed with appropriate surroundings. The museum and sanctuary are open to the public under certain restrictions. A warden is employed constantly to take charge of the sanctuary and museum.

CHAPTER XVII

BIRD-PROTECTION BY GOVERNMENTS — STATE AND NATIONAL

Work of State Governments

BRIEF mention has been made in a previous chapter of the work done by the Audubon Societies in procuring legislation. The nature of this legislation may now be examined a little more carefully.

History of legislation. The first laws for the protection of song-birds were passed during the last of the eighteenth century, but it was not till the middle of the nineteenth century that laws protecting these birds began to be general. These were first adopted in the States in the northeastern United States, later by those in the western United States, and still more recently by the States in the South, till now every State in the Union accords some degree of protection to the song-birds.

In the first laws the distinction between the insectivorous birds, which were to be protected at all times, and the game-birds, for which open seasons were to be allowed, was not clearly defined. In 1886 the Bird Protection Committee of the American Ornithologists' Union drafted a law which has since been known as the Model A.O.U. Law, and

has formed the basis for nearly all bird legislation since that time. This law, with some modifications, has been adopted in forty States. The provisions of the law may be briefly summarized as follows: —

1. A definition of what constitutes game-birds.
2. A list of injurious birds.
3. Protection of all other birds, their nests and eggs.
4. Permission to collect birds for scientific purposes.
5. Statement of the fine for violation of the law.

Changes still needed in some States are a reduction of the number of birds exempted from protection so as to exclude only the injurious birds, especially among the hawks and owls, and the removal of all song-birds from the game list. More than half of the States have laws prohibiting Sunday shooting, thus making this a closed season for all birds.

Bird Day. Bird Day is now officially recognized in the following nine States: California, Connecticut, Delaware, Illinois, Louisiana, Minnesota, Ohio, Virginia, and Wisconsin.

Game laws. For game-birds a separate set of laws is enacted which prescribes regulations regarding: (1) the open season when game may be shot; (2) the shipment of game outside of the State; (3) the sale of game; (4) the bag-limit; (5) the procuring of licenses for hunting and shipping game.

Formerly spring and summer shooting were permitted, but now nearly all States forbid shooting

at these seasons, and limit it to the fall and winter, or fall alone. The length of the open season ranges from two to four months. Sometimes when the bird is very rare no open season is allowed.

Most of the States prohibit export of all game protected by local laws, except that sportsmen may take out a limited amount under special restrictions. Twenty-two States prohibit the sale of all protected game at all seasons. Twenty-five others prohibit the sale of certain kinds of game at all seasons. About two thirds of the States permit the sale of game raised in captivity.

All States, with three exceptions, have laws limiting the amount of game that may be killed or had in possession in a day. The number allowed, ranging from fifteen to fifty, is too large to afford adequate protection to birds. Following is the Minnesota law: "Licensed resident: 15 ducks, 10 other birds combined, a day; 45 ducks, 30 other kinds combined, in possession."

In all the States licenses must be secured by non-residents before they can hunt any or certain kinds of game. This fee varies from ten to twenty-five dollars. In forty-two States residents are also required to secure a license, but the fees are much smaller, usually about a dollar. In about half of the States a special kind of hunting-license, called the "alien license" has been adopted to restrict hunting by persons who are not citizens of the country. In

some States aliens are not allowed to hunt or to own guns.

The protection of game-birds has a practical side as furnishing a supply of food. Dr. W. T. Hornaday estimates that if our game-birds and game quadrupeds had been properly conserved, they would now be yielding each year ten million dollars' worth of food.

Summary. Summarizing the legislation of recent years, we may note that the tendency is constantly and consistently toward giving birds more complete protection. Following are some tendencies as shown in recent state legislation: —

The protection at all seasons of all birds except game-birds and injurious birds.

Removing all song-birds from the list of game-birds.

Granting a prolonged closed season for game-birds which are very scarce.

Shortening the open season for game-birds.

Prohibiting spring, summer, and winter shooting.

Reducing the bag limit.

Prohibiting the export of game-birds.

Prohibiting the sale of game-birds.

Limiting the shooting of game-birds to those who have obtained licenses.

Prohibiting the sale of feathers of wild birds.

Prohibiting the use of feathers of wild birds for millinery purposes.

Restrictions on the kinds of weapons that may be used.

Work of the National Government

The United States Bureau of Biological Survey. One of the most important steps ever taken in this country in the interest of bird-protection was the establishment, in 1885, of the United States Bureau of Biological Survey, as a result of the activities of the American Ornithologists' Union. This Bureau began the study of the economic relations of birds. The findings of this study have been the foundation for nearly all the legislation in this country for the protection of song-birds and birds of prey. The facts here found regarding the food of birds have been the chief arguments used in influencing legislatures to pass laws protecting birds. The Audubon Societies have worked in close touch with the Bureau of Biological Survey. All important plans and movements of the National Association are adopted after consultation with the Bureau.

The work of the Bureau was first started by Dr. C. Hart Merriam who, with one assistant, began to investigate the economic relations of birds to agriculture. The number of men employed has been increased and the scope of the field enlarged, till it now includes the study of the economic relations of mammals, the geographic distribution of plants and animals, and the supervision of matters pertaining to game-protection and the importation of foreign birds and animals; and now the preparation of the regu-

lations for the new Migratory Bird Law has been entrusted to the Bureau.

An explanation of the methods used in investigating the food of birds has already been given in Chapter VII.

The Lacey Act. The first federal law passed dealing with the protection of birds was the Lacey Act, approved in 1900. This was important as establishing the principle that the protection of birds came within the jurisdiction of the National Government. It contains three main divisions: (1) it places the preservation of birds under the jurisdiction of the Department of Agriculture; (2) it authorizes the Secretary of Agriculture to regulate the importation of foreign birds and animals, and prohibits the introduction of the mongoose, "flying foxes," English sparrow, starling, or other species which may be declared injurious; and (3) it prohibits interstate traffic in birds killed in violation of state laws.

This last provision was an important step in helping to protect the game-birds, as hitherto there had been much shipping and sale of game out of the State where it was killed.

The Migratory Bird Law. Since the passing of the Lacey Act various bills have been introduced into Congress whose purpose was to protect migratory birds. One was introduced into the House of Representatives in 1904 by Hon. George Shiras, 3d. Another was introduced in 1908 by Hon. John

W. Weeks, and again one in 1909 by the same author, but none of these received favorable consideration. Again, in 1911, Hon. John W. Weeks introduced a bill in the House, and later Senator McLean, of Connecticut, introduced an identical bill in the Senate. By this time enough sentiment had been aroused in the country regarding the protection of birds, so that the bill was given serious consideration. The friends of birds coöperated and waged a long and successful campaign in favor of this bill. Governors and legislatures were asked to send resolutions to Congress endorsing it. Sportsmen's organizations, zoölogical societies, and scientific bodies passed resolutions and sent them to their Representatives in Congress. The Audubon Societies sent thousands of letters and telegrams to Senators and Representatives. Some of the organizations whose officers and members aided in the campaign are: The American Game Protective and Propagation Association, the Camp-fire Club of America, the New York Zoölogical Society, the Boone and Crockett Club, the National Federation of Women's Clubs, the Long Island Sportsmen's Association, the State Audubon societies, and numerous sportsmen's clubs scattered throughout the country. The game commissioners of nearly every State and thousands of individual workers strove for the passage of the Weeks-McLean bill.

The efforts of these friends of the birds were

finally successful and the bill was passed without one dissenting vote in the Senate, and with only fifteen votes cast against it in the House. One of the last official acts of President Taft was the signing of this bill on March 4, 1913.

This was the most important step ever taken by any country in the interest of bird-protection. Following is the text of the law: —

SECTION 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That all wild geese, wild swan, brant, wild ducks, snipe, plover, woodcocks, rail, wild pigeons, and all other migratory game and insectivorous birds, which in their northern and southern migrations pass through, or do not remain permanently the entire year within the borders of any State or Territory, shall hereafter be deemed to be within the custody and protection of the Government of the United States, and shall not be destroyed or taken contrary to regulations hereinafter provided therefor.

SECTION 2. That the Department of Agriculture is hereby authorized to adopt suitable regulations to give effect to the previous section by prescribing and fixing closed seasons, having due regard to the zones of temperature, breeding habits, and times and lines of migratory flight, thereby enabling the department to select and designate suitable districts for different portions of the country within which said closed seasons it shall not be lawful to shoot, or by any device kill or seize and capture migratory birds within the protection of this law, and by declaring penalties by fine of not more than one hundred dollars or imprisonment for ninety days, or both, for violation of such regulations.

SECTION 3. That the Department of Agriculture, after

the preparation of said regulations, shall cause the same to be made public, and shall allow a period of three months in which said regulations may be examined and considered before final adoption, permitting, when deemed proper, public hearings thereon, and after final adoption to cause same to be engrossed and submitted to the President of the United States for approval: Provided however, That nothing herein contained shall be deemed to affect or interfere with the local laws of the States and Territories for the protection of non-migratory game or other birds resident and breeding within their borders, nor to prevent the States and Territories from enacting laws and regulations to promote and render efficient the regulations of the Department of Agriculture provided under this statute.

SECTION 4. That there is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, for the purpose of carrying out the provisions of this act, the sum of ten thousand dollars.

This bill applies only to the migratory birds and not to the permanent residents, and regulates the closed and open seasons for game-birds, but the States are left to regulate matters such as the kinds of guns that may be used, sale of game within the State, and bag-limits. This bill does not take the place of the state laws protecting birds, but is added to them, so that an offender may be prosecuted twice, once under the state laws and again under the federal law.

Advantages of federal law. The advantages of this federal law over the state laws are many. First, it insures a uniform regulation. Under the state laws a bird may be protected in one State and killed in another, as was true of the robin.

Second, it controls the open season so as to give better protection to game-birds. Under the state regulations a bird might be shot from the time it left its home in the North all the way on its migration South. The state control of game has proved a failure. No State has given its game adequate protection. The number of game-birds has been steadily decreasing under state control, some being threatened with extermination. It seems almost certain that under federal control birds will be more effectively protected, and that their numbers will soon begin to increase; and already this increase has been noted in some localities.

Third, it means permanency of bird-protection. Under the state systems at the meeting of nearly every legislature efforts are made to repeal some of the laws protecting birds and to pass new laws which permit the killing of more birds.

Fourth, federal laws are generally better enforced and more feared than state laws, and so are more effective.

The preparation of the regulations for the protection of migratory birds was entrusted to a committee of experts from the Bureau of Biological Survey. These Regulations form one of the most important scientific documents ever issued on the subject of bird-protection. Portions of these regulations are quoted below, as amended August 16, 1916: —

Regulation 1: Definitions

For the purposes of these regulations the following shall be considered migratory game birds: —

(*a*) Anatidæ, or waterfowl, including brant, wild ducks, geese, and swans.

(*b*) Gruidæ, or cranes, including little brown, sandhill, and whooping cranes.

(*c*) Rallidæ, or rails, including coots, gallinules, and sora and other rails.

(*d*) Limicolæ, or shore birds, including avocets, curlew, dowitchers, godwits, knots, oyster-catchers, phalaropes, plover, sandpipers, snipe, stilts, surf-birds, turnstones, willet, woodcock, and yellow-legs.

(*e*) Columbidæ or pigeons, including doves and wild pigeons.

For the purposes of these regulations the following shall be considered migratory insectivorous birds: —

(*f*) Bobolinks, catbirds, chickadees, cuckoos, flickers, flycatchers, grosbeaks, hummingbirds, kinglets, martins, meadowlarks, nighthawks or bullbats, nuthatches, orioles, robins, shrikes, swallows, swifts, tanagers, titmice, thrushes, vireos, warblers, waxwings, whip-poor-wills, woodpeckers, and wrens, and all other perching birds which feed entirely or chiefly on insects.

Regulation 2: Closed season at night

A daily closed season on all migratory game and insectivorous birds shall extend from sunset to sunrise.

Regulation 3: Closed season on insectivorous birds

A closed season on migratory insectivorous birds shall continue throughout the year, except that the closed season on reedbirds or ricebirds in New Jersey, Pennsylvania, Delaware, Maryland, the District of Columbia,

Virginia, North Carolina, and South Carolina, shall commence November 1 and end August 31, next following, both dates inclusive: *Provided*, That nothing in this or any other of these regulations shall be construed to prevent the issue of permits for collecting birds for scientific purposes in accordance with the laws and regulations in force in the respective States and Territories and the District of Columbia.

Regulation 4: Closed seasons on certain game birds

A closed season shall continue until September 1, 1918, on the following migratory game birds: Band-tailed pigeons, little brown, sandhill, and whooping cranes, wood ducks, swans, curlew, willet, and all shore birds except the black-breasted and golden plover, Wilson snipe or jacksnipe, woodcock, and the greater and lesser yellow-legs.

A closed season shall also continue until September 1, 1918, on rails in California and Vermont; and on woodcock in Illinois and Missouri.

At the same time with the original regulations there was issued Circular No. 93, giving explanations of these regulations, from which the following is quoted: —

Laws for the protection of migratory birds hitherto enacted have usually provided long open seasons and have been framed mainly in the interests of the hunter rather than of the game. In preparing the regulations under the Federal law for the protection of migratory birds an effort has been made to reduce the open seasons to reasonable limits, to provide hunting at the time of the year when game birds are most abundant and in the best condition, and in all cases to give the benefit of the doubt to

the bird. Recognizing the fact that many species of shore birds and some of the water fowl have diminished to a point where they are approaching extinction, protection has been extended to several species throughout the year and to others at least three fourths of the year. The preparation of the regulations was entrusted to a committee of members of the Biological Survey appointed by the Acting Secretary of Agriculture on March 21, 1913. The members of this committee were: T. S. Palmer, Assistant Chief, chairman; A. K. Fisher, in charge of Economic Investigations; and W. W. Cooke, Migration Expert. The committee at once took up the work of examining the data on file in the Biological Survey relating to the distribution, migration, and protection of migratory birds, had a series of maps prepared, collected much special information, and after numerous conferences recommended the regulations contained in Circular 92. These regulations differ from the ordinary restrictions under state laws, since they take into consideration the entire range of the species and the condition of the birds at all times of the year and not merely the local conditions when a certain species is most abundant in some particular State or region.

Basis of the Regulations

In carrying out the statutory requirements of "due regard to the zones of temperature, breeding habits, times and lines of migratory flight," the following are some of the more important principles on which the regulations have been based: —

To limit the list of migratory game birds to species properly so called and to eliminate species too small to be considered legitimate game or too rare to be longer hunted for sport or profit. This list has been made to conform as closely as possible with the statutory definitions of game.

To prevent spring shooting.

To protect migratory birds between sunset and sunrise.

To provide protected flight lines along at least two of the great navigable rivers.

To make the seasons approximately equal in length in different parts of the country.

To limit the hunting seasons to a maximum of three or three and one-half months.

To regulate these seasons according to latitude and times of migration and to adjust them so that there may be a reasonable opportunity of securing thirty days' shooting of any species at a given place.

To provide separate seasons for water fowl, rail, shore birds, and woodcock. The woodcock seasons are made to conform as nearly as possible with the seasons for upland game under state laws, so that there may be no opportunity in close seasons to hunt quail or grouse under the guise of shooting woodcock.

To curtail hunting at the end instead of the beginning of the open season, in the interest of both birds and the sportsmen.

To utilize all the protection now accorded by the closed seasons under state laws and extend these seasons when necessary.

Effect of the Regulations

The probable effect of these regulations may be briefly stated as follows: —

(1) Uniformity in protection of migratory game and insectivorous birds in the several States.

(2) Protection of birds in spring while en route to their nesting grounds and while mating.

(3) Uniformity in protection of migratory birds at night.

(4) Establishment of protected migration routes along two great rivers in the central United States.

(5) Complete protection for five years for the smaller shore birds and other species which have become greatly reduced in numbers.

(6) Reduction of the open season on migratory game birds, but in most cases not more than twenty-five to fifty per cent.

(7) No change in existing conditions before October 1, 1913.

Three months were allowed for criticism, during which public hearings were given, and then finally, with a few minor changes, the regulations were approved by President Wilson and became effective October 1, 1913.

Congress in the session of 1914 appropriated $50,000 for the enforcement of this law. Federal wardens have been appointed to coöperate with the state wardens in the enforcement of this law and of the law regulating interstate shipment of game.

The provisions of this federal law may be briefly summarized by saying that four kinds of protection are granted to migratory birds: —

1. Permanent protection, granted to all migratory insectivorous birds.

2. Limited protection, for five years to certain game-birds which are very scarce, including sixty-two species.

3. Seasonal protection, of about nine months to migratory game-birds.

4. Nightly protection, given to all birds between sunset and sunrise.

The constitutionality of this law has been challenged and the matter has been brought to the Supreme Court of the United States, but the decision has not yet been given. Careful students of the law believe that it will stand the test of constitutionality.

Tariff regulations. At the first session of Congress in 1913 bird-lovers fought and won another great battle for the birds. Congress in its revision of the tariff adopted the following schedule prohibiting the importation of feathers: —

> *Provided,* that importation of aigrettes, egret plumes, or so called osprey plumes, and the feathers, quills, heads, wings, tails, skins, and parts of skins of wild birds, either raw or manufactured, and not for scientific or educational purposes is hereby prohibited, but this provision shall not apply to the feathers of domestic fowls of any kind.

When the matter was under consideration by the House Committee on Ways and Means, friends of bird-protection appeared before it asking that the importation of feathers be prohibited. This was adopted by the House and the bill was sent to the Senate. The Senate Finance Committee made such radical changes as to make the provision worthless for the purpose originally intended. The friends of bird-protection made strenuous efforts to have the tariff provision inserted as it came from the House, and the Senators were deluged with letters and telegrams demanding that this provision be retained

unchanged. When the matter finally came to the Democratic caucus, it rejected the report of the Senate Committee and adopted the House provision prohibiting the importation of the plumage of wild birds except for scientific and educational purposes. This was later adopted by the Senate.

National Bird Reservations. On March 14, 1903, President Roosevelt issued the following order: —

> It is hereby ordered that Pelican Island in Indian River, Florida, is reserved and set apart for the use of the Department of Agriculture as a preserve and breeding-ground for native birds.

Thus was the first National Bird Refuge set aside and a government policy was then initiated which has since been expanded into a system of many bird refuges. The need of such reservations was first brought to the attention of President Roosevelt by the National Association of Audubon Societies, some of whose members had noticed the needless destruction of birds on these islands.

As the question was raised as to whether the President had power to set aside such reservations, a little later a bill was enacted by Congress giving the President authority to establish reservations of this character on government lands not fitted for agriculture. Most of these are situated on small, rocky islands or on tracts of marsh land of no value to man. These reservations vary in size from two acres (Hog Island, Wisconsin, the home of a colony

of gulls) to the very large Hawaiian Island reservation, which extends over five degrees of longitude and includes the breeding-ground of over a million sea-birds.

The National Association of Audubon Societies has agents in the field making searches for areas suitable for such reservations, and when found they are brought to the attention of the President of the United States. Birds are given protection at all times on these reservations, wardens are stationed on the most important ones, and the National Association of Audubon Societies coöperates with the Department of Agriculture in protecting the birds. The policy thus initiated by President Roosevelt has been followed by Presidents Taft and Wilson till the Government has sixty-nine bird reservations up to January 20, 1915.

The purpose of these reservations is threefold: first, to protect important breeding-colonies of water-birds; second, to furnish refuges for migratory species on their northern and southern flights; and third, to furnish refuges for migratory species during the winter.

These bird reservations may be grouped into six districts: —

1. The Gulf District, including ten in Florida, four in Louisiana, and one in Porto Rico. The chief birds protected are brown pelicans, gulls, terns, herons of various kinds, and ducks.

2. The Lake District, including two in Michigan, two in North Dakota, and one in Wisconsin. The principal birds protected here are breeding colonies of gulls, ducks, and white pelicans.

3. The Mountain District, including twelve in the Rocky Mountain States, South Dakota, and Nebraska. These serve as a refuge for water-fowl and shore-birds during the spring and fall migrations.

4. The Pacific District, including eight in Washington, four in Oregon, and three in California. The reservations on the coast contain great rookeries of sea-birds. The inland reservations contain breeding colonies of gulls, Caspian terns, grebes, white pelicans, ducks, and geese.

5. The Alaskan District, including eight reservations. In these reservations are nesting-grounds of sea-birds, ducks, and geese.

6. The Hawaiian District, including one reservation. Large numbers of sea-birds are found here.

Besides these reservations which have been created especially for protecting birds, there are a number of other reservations which were set aside for other purposes, in which birds receive special protection. These include (1) ten National Parks; (2) five Military Parks; (3) nine national game preserves and other refuges for wild life; (4) ten reservations for aquatic species; and (5) seven national reservations made into game preserves in whole or in

part by state laws. These, together with the bird reservations, constitute one hundred and ten reservations in which birds receive special protection.

The following are the ten National Parks that may be considered bird refuges: Yellowstone, Wyoming; National Zoölogical Park and Rock Creek Park, in the District of Columbia; Sequoia, Yosemite, and General Grant, California; Mount Rainier, Washington; Crater Lake, Oregon; Wind Cave, South Dakota; Glacier, Montana, — having a total area of 4,320,000 acres.

The National Military Parks were created to commemorate some notable engagement during the Civil War. There are five of these, situated at Chickamauga and Chattanooga, Antietam, Shiloh, Gettysburg, and Vicksburg, with a total area of eleven thousand acres. These refuges are important because their location is such that, in connection with some other reservations, they form a chain of refuges almost in line with the migratory flights of the birds.

The largest national reservation which has become a game preserve through state laws is the Superior National Forest, Minnesota, including 1,420,000 acres.

The next great step needed in the cause of bird-protection is to make every national forest a national game preserve in which no hunting for sport shall be allowed. Then these areas will produce

enough birds to keep the surrounding country well supplied.

State reservations. Some of the States have also set aside game preserves, notably Pennsylvania (with five), New York, Montana (with three), Wyoming (with two), Rhode Island, Louisiana, Idaho, California, Oregon (with six, including 1,700,000 acres). In Wisconsin are twenty-two refuges with an acreage of thirty thousand acres, including five state parks, the University grounds at Madison, and a number of private refuges. The preserves in New York State amount to about a million acres.

In Iowa, game preserves are being established in every county, wherein no shooting will be allowed for five years, and where the birds will be provided with food and shelter during severe weather.

CHAPTER XVIII

BIRD CLUBS

Meriden Bird Club. Other agencies which are aiding the cause of bird-protection are bird clubs which have been organized in various parts of the country. The best known of these is the Meriden Bird Club, in Meriden, New Hampshire, organized through the efforts of Mr. Ernest Harold Baynes, who has been instrumental in the organization of many other clubs. Meriden is a small village of about three hundred inhabitants and is the seat of Kimball Union Academy. The students of the Academy and the people of the village were first interested in birds by lectures given by Mr. Baynes, and in December, 1910, the club was organized. The club had for its objects "the increase and protection of our local wild birds, the stimulation of interest in bird life, and the gradual establishment of a model bird sanctuary." The total number of members the first year was 214, and 356 the second year. There are many associate members interested in the formation of the club who are scattered over about thirty States. During the winter special attention is given to feeding the birds. In the spring, nesting-houses are put up by the members of the club. A

campaign has been carried on against the English sparrows till the town is practically free of them. Most interesting results have attended these efforts to befriend the birds. Many nesting-houses are occupied, and in the winter flocks of a great variety of birds are constant visitors at the feeding-stations. Seven species of birds in this little town have become so tame as to feed from the hand.

The chief matter to which attention was given was the establishment of a bird sanctuary. A friend offered to give one thousand dollars toward this, and a farm of thirty-two acres in the edge of the village was bought and named the "Helen Woodruff Smith Sanctuary," after the donor. This is being gradually developed so as to make it attractive to the birds. Shrubs have been planted, nesting-boxes put up, and feeding-stations planned for the winter. At the dedication of this bird sanctuary, Percy MacKaye's bird masque, "Sanctuary," was first presented.

Other activities of the club are to place bird charts in local schools, to start a library of bird books, to conduct a column of bird notes in the local paper, to offer prizes for essays and photographs, and to organize other bird clubs. The club publishes an annual report setting forth its activities during the year. The influence of this club has been widely felt, and as a result many other bird clubs have been organized.

Brush Hill Bird Club. The Brush Hill Bird Club

of Milton, Massachusetts, published its first report in 1914. The preface begins: —

> The Brush Hill Bird Club wishes to impress on all who chance to see this Report that our Club is not composed of learned ornithologists, in fact, most of us know comparatively few birds. Our aims are to protect the birds and to attract them about our houses and grounds. Our watchword is "Conservation."

Following are some of the activities of this club which were carried on in appreciation of their opportunity for useful service to their community: —

1. Bird-houses were put up by the members.
2. A campaign of education was waged through the library and schools.
3. The library was supplied with bird books and magazines.
4. Plans were made to attract birds to the public park by providing feeding-stations, nesting-houses, and bird-baths.
5. Bird lectures were given.
6. Articles regarding birds were supplied to the local papers.
7. An exhibition was held in the public library.

The chief activity for the first year was the preparation of this exhibition, which was kept in the library for two months. As this is very suggestive of what might be done elsewhere, a brief outline is given of the chief features of this exhibit: —

1. Nesting-boxes.
2. Devices for feeding birds.
   - A. Feeding-stations.
   - B. Food-stick.

C. A bird's Christmas-tree.
D. Suet pudding.
E. Home-made bird pudding.
F. Bird breakfast foods. (A collection of grains and cereals to show how man can feed the birds.)
G. Nature's method of feeding the birds. (A collection of branches of trees and shrubs bearing berries and seeds.)

3. English sparrow trap.
4. Bird books and magazines.
5. Bird portraits and colored outlines made by children.
6. Bird games.
7. Text of federal and state laws.
8. Cloth signs for posting.

The constitution of the Brush Hill Bird Club is given as being suggestive for use in the organization of other bird clubs.

CONSTITUTION OF THE BRUSH HILL BIRD CLUB

Article I — Name

This Club shall be known as the Brush Hill Bird Club.

Article II — Purpose

The purpose of this Club shall be to encourage protection of and interest in bird life in our community.

Article III — Membership

Section 1. The membership in this Club shall consist of Active Membership, Active Family Membership, Associate Membership, Life Membership, Patrons and Benefactors.

Section 2. Any resident of the Brush Hill–Blue Hill district of Milton may become an active member on payment of the prescribed dues.

SECTION 3. Any family residing in the Brush Hill–Blue Hill district of Milton may obtain a Family Membership on payment of the prescribed dues.

SECTION 4. Any non-resident in sympathy with the purpose of this Club may become an Associate Member on payment of the prescribed dues.

SECTION 5. Any person may become a Life Member on payment of the prescribed fee.

SECTION 6. Any person may become a Patron on payment of the prescribed fee.

SECTION 7. Any person may become a Benefactor on payment of the prescribed fee.

SECTION 8. The dues for Active Members shall be $1, payable annually.

SECTION 9. The dues for Active Family Membership shall be $5, payable annually.

SECTION 10. The dues for Associate Membership shall be $1, payable annually.

SECTION 11. The fee for Life Membership shall be $25.

SECTION 12. The fee for a Patron shall be $100.

SECTION 13. The fee for a Benefactor shall be $1000.

SECTION 14. The voting power shall be limited to active members.

ARTICLE IV — MEETINGS OF THE CLUB

Meetings shall be held at the discretion of the Executive Committee. The first meeting after September 1 shall be the business meeting, at which the election of officers for the ensuing year shall be held.

ARTICLE V — GOVERNMENT

The officers of the Club shall consist of a President, Vice-President, Secretary, Treasurer, and General Manager. The officers of the Club shall constitute the Executive Committee, which Committee shall pass upon all business that is to be brought before the Club for action.

Burroughs Nature Club. The Burroughs Nature Club was organized in 1910 for the purpose of studying Mr. Burroughs's writings, and local clubs have been formed in many towns. This club has taken a special interest in the protection of bird life.

Examples of the development of the Burroughs Club idea appear in the bird sanctuaries established by the organization. Among the most notable is the "Wren's Nest," the old home of Joel Chandler Harris at Atlanta, Georgia, dedicated by Mr. Burroughs himself by placing a wren's nesting-box on a branch near the porch where so many of the Uncle Remus stories were written.

The Cottage Grove and Fernwood Sanctuary was established by the Rochester Burroughs Club on the shore of Lake Ontario.

Near Ellenville, Ulster County, New York, the Mount Meenahga estate of seven hundred acres, in the midst of a wild section of about four thousand acres, has become one of their regular sanctuaries, where there have been erected over one hundred nesting-boxes and devices for winter feeding.

Each year, Burroughs's birthday, April 3, is observed by the dedication of new sanctuaries, usually consisting of school grounds or public parks. The year 1915 saw this done in Utica, New York, and in Toledo, Ohio, where the bird-boxes were made by the children and placed in the parks, with the coöperation of the city government.

JOHN BURROUGHS AT THE DEDICATION OF "WREN'S NEST" IN ATLANTA, GA., BY THE BURROUGHS NATURE CLUB

FIELD DAY IN RENWICK WOODS, ITHACA, N.Y.

Mr. L. A. Fuertes addressing the Cayuga Bird Club

The Governor of Utah proclaimed Burroughs's birthday as a State Bird Day, with the recommendation that the grounds surrounding all schoolhouses and all public parks and cemeteries be dedicated to the birds. This recommendation is rapidly being carried out. The schools have taken it up generally, and in 1915 the campus of the University of Utah (a tract of ground one hundred and fifteen acres in extent) was dedicated as a bird sanctuary.

Their latest effort is to start a bird sanctuary in a residential park bordering on Prospect Park, Brooklyn.

Members are urged to establish bird refuges in the summer resorts where they spend their vacations.

Liberty Bell Bird Club. The Liberty Bell Bird Club was organized in 1913 by the "Farm Journal," Philadelphia. Its object is to protect song and insectivorous birds. Special effort is made to interest people in the country. On July 1, 1916, its membership was 706,000. Those who desire to become members sign the following pledge and receive free the club button and a little pamphlet entitled, "Guide of the Liberty Bell Bird Club": —

Pledge. I desire to become a member of the Liberty Bell Bird Club, and promise to study and protect all song and insectivorous birds and to do what I can for the Club.

The club has installed bird sanctuaries in three of the largest cemeteries in the country.

The "Guide" for 1916 reports that they have fought the battle for the birds before 3577 county superintendents and 166,471 teachers, and have introduced bird-study into 15,615 schools up to July 1, 1915.

Bird club activities. The following summary shows the activities that have been carried on by the various bird clubs: —

1. Meetings of club members.
   - A. Field trips to study birds.
   - B. Evening meetings for the discussion of bird topics.
2. Individual work of club members.
   - A. Provide nesting-houses.
   - B. Feed winter birds.
   - C. Provide fountains.
3. Work with school-children.
   - A. Bird talks to children.
   - B. Furnish pictures, bird leaflets, and bird books.
   - C. Form children's bird clubs.
   - D. Offer prizes for best nesting-houses and essays.
   - E. Present feeding devices to school.
4. Means of educating the public and arousing interest.
   - A. Bird items in local newspapers.
   - B. Issuing circulars for general distribution.
   - C. Lectures given, open to the public.
   - D. Public library supplied with bird books and magazines.
   - E. Exhibitions held in some public place.
5. Establish feeding-stations for winter birds.
6. Establish bird sanctuary, or make sanctuary out of parks.
7. Manufacture and sale of devices for attracting birds.

8. Local bird warden appointed.
9. Protection of birds from their enemies.
   A. Destruction of English sparrow.
   B. Control of the cat.

The first annual report of the Brush Hill Bird Club gives a list of thirty-seven bird clubs, located chiefly in New England. The annual report of the National Association of Audubon Societies gives a list of twenty bird clubs affiliated with the National Association. Mr. Ernest Harold Baynes, who has been the prime factor in this movement, has organized about sixty bird clubs; so that there are probably about one hundred bird clubs to be found in the United States.

The organization of a bird club enables those interested in birds to work more effectively than would be possible individually, and many people who are not acquainted with birds are interested in the opportunity for doing public service through the conservation of valuable birds. Interest may be aroused by having some one deliver a lecture on birds. A club may be organized at the close of such a lecture. Details regarding the methods to be used are given in Mr. Ernest Harold Baynes's "Wild Bird Guests."

One interesting result of these bird clubs has been the effect upon the communities in which they have been organized. Frequently a feeling of indifference to bird life has been changed to one of enthusiasm

for bird-protection. In some cases the club has served as a center of general interest for the whole town and has been a means of arousing a community spirit.

Other organizations which have been active in the protection of birds and wild life in general are the New York Zoölogical Society, the Boone and Crockett Club, the Camp-fire Club of America, the American Game Protective and Propagation Association, the Wild Life Protective Association, and the State Game Protective Associations.

Private game preserves. There are in the United States about five hundred private game preserves. These may be controlled by hunting-clubs or privately by individuals. They are kept for the sake of raising game, either naturally or by artificial methods, so as to furnish shooting for the owners. Some of them are duck preserves and marshes, and some are upland preserves for big game or game-birds. They may vary in size from 1000 acres or less up to 125,000 acres. In New York State the private game preserves comprise an area of 800,000 acres. In these preserves native game is protected and is sure to increase, and some of the birds spread out and help to maintain the game-supply in the surrounding country. So while there have been some objections raised against these private game preserves, on the whole they tend toward the conservation of bird life.

In Dearborn, Michigan, Mr. Henry Ford has a

farm of twenty-eight hundred acres which has been given to bird attraction and protection. Mr. Jefferson Butler, one of Michigan's ornithologists, was employed before his death to superintend the development of the farm. The entire farm is managed with the sole thought of attracting birds. Bird-enemies are disposed of. Shrubs and vines are planted the fruits of which are eaten by birds. Thickets are allowed to grow to furnish nesting-sites for birds. A river has been dammed to make a marsh of thirty acres for the water-birds. Varieties of nesting-boxes have been put up by the hundreds. Automatic feeding-devices are kept in many places and these are well supplied with food during the winter.

The results are already evident in the increased number of birds. One writer estimates that there are ten times as many birds to the acre on this farm as anywhere else in the State. In a glen by the river, about two hundred feet long by thirty feet wide, twenty-three pairs of birds, including fifteen species, were found nesting in one season.

Mention may be made also of Messrs. Edward A. McIlhenny and Charles W. Ward, who have done much for the protection of birds in the State of Louisiana through the establishment of bird preserves. They at first established a private preserve of about fifty thousand acres on the coast of Louisiana, in the heart of the greatest winter home of ducks on the continent of North America. Game

wardens were hired to protect this and to prevent shooting. Later they gave thirteen thousand acres of this to the State of Louisiana as a perpetual bird refuge. They were also instrumental in having the Marsh Island Reserve of seventy-five thousand acres bought by Mrs. Russell Sage, who contributed $150,000 for this purpose. This has now been offered to the Government to be kept as a bird refuge. Later the Carnegie Foundation acquired a large tract adjoining this of about eighty-five thousand acres, at a cost of $225,000. Together these extend along the coast for seventy-five miles and comprise about five hundred square miles. A fourth tract is gradually being acquired.

In New York, Mr. E. H. Litchfield has a fenced preserve in the Adirondacks of about ten thousand acres. Another fenced preserve of about three thousand acres in New York State is owned by Mr. C. P. Dieterich.

In New Jersey, Mr. Charles C. Worthington has a large bird refuge of eighty thousand acres which he has offered to the State of New Jersey to be held as a permanent game refuge.

Recently the Minnetonka Bird Sanctuary has been established along Lake Minnetonka, near Minneapolis, Minnesota, as a result of a petition of hundreds of residents of that section. This includes a tract of about fifty-five thousand acres. The State Game Commission has prohibited shooting

and even the carrying of firearms either on the lake or on a surrounding zone of land one mile in width.

A number of years ago a tract of two acres, situated near the grounds of the University of Cincinnati, was purchased by a woman interested in birds, at a cost of $250,000. This is to be made a bird park and has been given to the city. Its development is under the charge of the Department of Biology of the University of Cincinnati.

City and state ornithologists. The city of Pittsburgh, Pennsylvania, has appointed a city ornithologist whose duty it is to protect birds in the city from molestation, especially when nesting; to erect bird-houses; to provide food for wild birds; and to report annually upon the increase or decrease of the birds. Under a recent law passed in Massachusetts, the towns of Dover, Brookline, and Milton have appointed bird wardens. Within recent years state ornithologists have been appointed in the following States: Massachusetts, Connecticut, Vermont, Pennsylvania, and Delaware.

Summary of what has been accomplished in protecting the birds. During the past quarter of a century remarkable strides have been made in the cause of bird-protection. Thirty years ago our common song-birds were used for millinery purposes. To-day many States have laws forbidding the use of feathers of wild birds for millinery purposes and the National

Government has prohibited the importation of the feathers of any wild birds.

Formerly game-birds were shot at all seasons of the year, were sold in the market in large numbers, and no limit was set on the number that could be shot; now shooting is allowed only in the fall, the sale of game is prohibited, and the number of game that may be killed is limited, though there is still opportunity for improvement along this line.

Formerly birds were almost entirely unprotected by law, and when laws were passed, there was often such lack of uniformity in the laws of the different States that the protection was very inadequate. To-day practically all the States give full protection to valuable insectivorous birds. Formerly the National Government gave no attention to the protection of birds; now it protects all the migratory game and insectivorous birds and has given a closed season of five years to many game-birds.

Formerly there was little general interest in birds and nothing was taught about them to children in schools. To-day there is a very wide-spread general interest in bird life, and many children in our schools are being taught the value of bird life and its protection.

Formerly there were few places where birds were safe from persecution; now there are many refuges, national, state, and private, where birds are protected at all times.

CHAPTER XIX

NESTING-BOXES

THE kind of protection discussed in the previous chapters has been chiefly of a negative character, in which the purpose is to stop the unnecessary killing of birds and to allow them to increase by natural methods. We come now to discuss a positive kind of protection, which includes the negative, but goes a step farther and seeks to increase the number of birds by providing the conditions essential to bird life. The things which man can furnish to meet these conditions are nesting-sites, food, and water.

Reasons for positive protection. The reasons why one might desire to carry on this positive kind of protection are fourfold: first, on account of the pleasure that one may derive from watching the birds thus brought around the home; second, on account of the help which the birds will render in the destruction of injurious insects; third, on account of the influence that the study of birds may have upon the children in the home and the school; and fourth, on account of the assistance one is giving to the conservation of valuable birds.

The pleasures of bird-study are increased many

times when one can find the birds right around one's home and know that he has been instrumental in bringing them there.

From the standpoint of the gardener, fruit-grower, and farmer, increasing the birds is a business proposition, the same as when one invests in a spraying-outfit for controlling the insects that prey upon the fruits and vegetables; only in this case the expense is negligible, and after the birds are once brought to the farm and garden, their work in destroying insects continues from sunrise to sunset without any effort on the part of the farmer. There are on record many instances showing the resulting benefits when systematic efforts are made to encourage the presence of birds. Mr. E. H. Forbush cites an instance of four young apple trees which were infested with plant-lice. Two of the trees, which were located near houses containing families of bluebirds and chickadees, were almost entirely cleared of the lice by these birds, while the other two, which were some distance away, finally died from the effect of the pests.

Evidence of the value of attracting birds comes also from Germany, where systematic experiments have been carried on. In the spring of 1905 the larvæ of a moth attacked a large wood near Eisenbach, and stripped it almost entirely of its foliage; while in the neighboring wood at Seebach, in which nesting-houses had been systematically placed, the

trees were uninjured. A similar effect was noticed in the orchards. At Seebach the trees always escaped the devastation of insects, while the neighboring orchards frequently suffered from their attacks.

To the parent and teacher, attracting birds has a special interest on account of the relation of this work to child life. Children are naturally interested in bird life and especially enjoy making bird-houses. This kind of work has a beneficial effect on children, because it teaches a sort of care, a sense of responsibility for those birds which their efforts have brought around the house.

And, lastly, to every citizen interested in furthering the conservation of the resources of the country this work appeals. It does not follow that one need to be especially familiar with the birds in order to be interested in this line of work, if one but appreciates the value of bird life and the need of conserving it. Some of the bird clubs recently organized have been formed by people who know very few birds, but who are interested in doing something for the welfare of the community in which they live.

Need of nesting-boxes. With the rapid increase of population in our cities and towns and their corresponding growth countryward, orchards, decaying trees, shrubbery, and other nesting-sites are steadily disappearing. As a result, in the suburbs of cities birds that nest in cavities find it difficult to obtain suitable nesting-sites, and as the old sites are cut

down the birds are driven farther out in the country to nest.

Birds using boxes. Whether any particular kind of bird will use a nesting-box depends primarily on its natural nesting-site. If it nests in a hollow tree or limb, there is a possibility that it may occupy these artificial nesting-boxes. There are other birds which usually build their nests in the open that may use open nesting-boxes. The birds which have been actually known to nest in bird-houses, as far as the author has been able to secure any records, are the following: —

Birds using nesting-houses

(Those marked with a * are quite common occupants)

*Bluebirds: —
  Eastern (*Sialia sialis sialis*).
  Western (*Sialia mexicana occidentalis*).
  Mountain (*Sialia currucoides*).
Chickadees: —
  Black-capped (*Penthestes atricapillus atricapillus*).
  Oregon (*Penthestes atricapillus occidentalis*).
  Carolina (*Penthestes carolinensis carolinensis*).
Duck, wood (*Aix sponsa*).
Finch, house (*Carpodacus mexicanus frontalis*).
*Flicker (*Colaptes auratus luteus*).
Flycatcher, crested (*Myiarchus crinitus*).
Hawk, sparrow (*Falco sparverius sparverius*).
*Martin, purple (*Progne subis subis*).
Nuthatch, red-breasted (*Sitta canadensis*).
Nuthatch, white-breasted (*Sitta carolinensis carolinensis*).
Owl, screech (*Otus asio asio*).

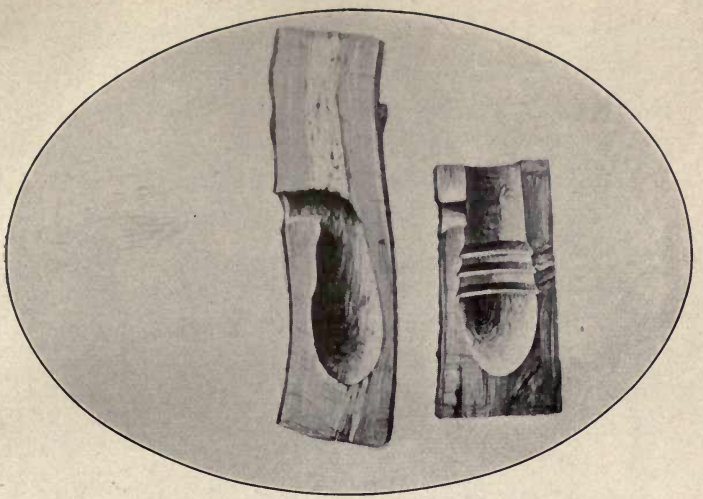
*Sparrow, English (*Passer domesticus*).
Starling (*Sturnus vulgaris*).
*Swallows: —
Tree (*Iridoprocne bicolor*).
Violet-green (*Tachycineta thalassina lepida*).
Titmouse, tufted (*Bœolophus bicolor*).
Warbler, prothonotary (*Protonotaria citrea*).
Woodpeckers: —
Downy (*Dryobates pubescens medianus*).
Hairy (*Dryobates villosus villosus*).
Red-headed (*Melanerpes erythrocephalus*).
*Wrens: —
House (*Troglodytes aëdon aëdon*).
Parkman's (*Troglodytes aëdon parkmani*).
Bewick's (*Thryomanes bewicki*).
Texas (*Thryomanes bewicki cryptus*).
Vigors's (*Thryomanes bewicki spilurus*).

The following have been reported as using the nesting-boxes of the open type; cardinal, catbird, purple finch, grackle, mockingbird, orchard oriole, phœbe, robin, song sparrow, and brown thrasher.

Types of houses. The great variety of houses now being made may conveniently be classified into three groups, based on the attempt to imitate the natural nesting-sites of birds. In the first group are those houses made in imitation of a woodpecker's nesting-site, both inside and outside; in the second group are those which imitate the natural nesting-sites on the outside only; and in the third group are those which make no attempt to imitate the natural nesting-sites either inside or outside.

Imitation both outside and inside. The best-

known houses of the first group are those devised by Baron von Berlepsch in Germany. He has made a special study of woodpeckers' nests, collecting hundreds of them, and he finds that they all agree in the following features: the opening is always circular and of unvarying size for each species; the lower portion of the nesting-cavity is enlarged in a gourd shape, and ends in a pointed trough at the bottom; the inner walls are roughened somewhat to allow the birds to cling to them more easily; and in the extreme point of the nest are a few fine shavings. Baron von Berlepsch has constructed a nesting-house embodying all these features. The results following the use of this house are very remarkable. Of five thousand boxes hung up by Baron von Berlepsch in his own woods, and of about ten thousand hung up in other localities by state authorities, ninety per cent or over were occupied. And this was true in some localities where unsuccessful experiments have been tried in previous years with other kinds of nesting-boxes. These houses are being made and sold in large quantities by a German manufacturer, and in one case are being made and used on a large scale by German state authorities. They are now being made by at least two firms in this country. This type may be made by splitting a limb in two and hollowing out the inside of each half in the proper shape and then fastening the two parts together by means of screws or nails.



LONGITUDINAL SECTIONS OF WOODPECKER'S HOLE AND OF VON BERLEPSCH NESTING-BOX

NATURAL NESTING-SITE OF A FLICKER IN AN OLD APPLE TREE

Imitation on outside only. In this type the houses are made of sections of small trees or of pieces of wood with the bark on, but there is no attempt to make the inside conform to the shape of a woodpecker's nest. It may be cylindrical, cubical, or of irregular shape. This type includes the following kinds of houses; bark houses, boxes made of slabs with the bark on, hollow limbs and sections of limbs, or small trees with a hole excavated by boring lengthwise with a large auger.

Bark houses. Very attractive houses can be made entirely of bark. Limbs of trees, or small trees of the desired size, should be cut into sections of ten or twelve inches in length, about the latter part of June. The bark can be easily removed and with the addition of a roof and floor may easily be made into a nesting-box. Very good imitations of tree-trunks may be secured by constructing boxes out of slabs with the bark on.

Sections of hollow trees or limbs make some of the very best bird-houses. Sometimes pieces may be found with the center already decayed, in which case it is only necessary to saw off a section of the desired length, fasten on a floor and a roof, and make the entrance hole. It is desirable that the roof be put on in such a way as to be readily removed. To hollow out a solid limb, saw it in halves from one end to about three inches from the other, where a cross-cut is made at right angles. The two pieces

may be gouged out to the desired size and wired or screwed together, so that they can be easily taken apart if desired; or if one has a large auger, a hole may be bored.

No attempt at imitation. The third type of house, in which no attempt is made to imitate the natural nesting-site, may be classified, according to the material of which they are made, as follows: wood, tin, pottery, cement, roofing-paper, and gourds. Of these wood is the most easily obtained and the most easily worked. A satisfactory box can be made out of ordinary boards, the older the better, as the birds are apt to be frightened away by new boards; but if new boards are used, they should be smeared with moist sand and exposed to the weather as long as possible before the birds are expected to use the house, or they may be stained or painted green or brown.

Tin houses. Quite a variety of houses may be made from various kinds of tin receptacles, such as tomato-cans, varnish-cans, coffee-cans, etc., by fitting in at one end a circular piece of wood containing the entrance hole. The author has been very successful in attracting house wrens by using old tomato-cans. An empty can was placed upon a hot stove, with the cut end down, till the solder was melted, and then the rest of the cover was knocked off with a poker. A circular piece of wood from a half-inch board was cut out so as to fit into

the can. A one-inch hole was made in the board a little above the center, and then the board was fastened in place by driving tacks through the tin. Nails were driven obliquely through the rear of the can into a strip of wood, by means of which the house was fastened in the desired position; or the can may be suspended by means of wire placed around it. In one can of this sort, made by the author, there were successfully reared, in four successive seasons, five broods of house wrens, making a total of from twenty-five to thirty young birds.

Pottery houses. The author has seen two styles of houses made of pottery or earthenware that are now on the market. This type of house has the advantage of being very durable as it is not affected by the weather.

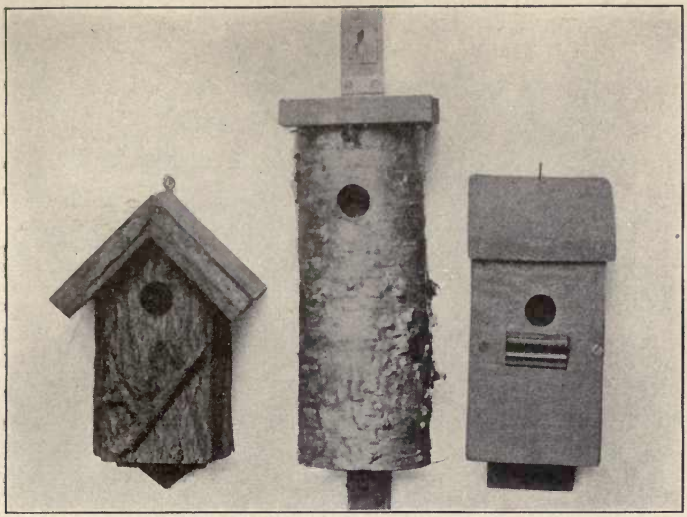
Cement boxes. One manufacturer makes cement boxes. These are durable and do not admit of undesirable birds and squirrels enlarging the hole. The cement also allows some ventilation. They are made with removable lids.

Boxes of roofing-paper. Another manufacturer makes houses out of roofing-paper. These are of cylindrical shape, light and durable. The top may be easily lifted and the box cleaned.

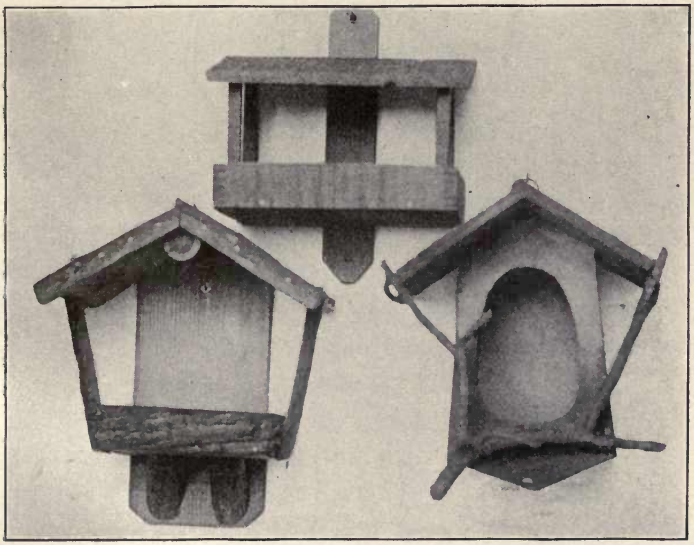
Comparison of types. When we come to compare these different types to decide which is the most attractive to the birds, we find each type of box has its champions. Mr. E. H. Baynes, in his "Wild

Bird Guests," writes very enthusiastically of the Von Berlepsch type, and prefers it to any other type. He cites twelve species of birds known to use these boxes, of which three species, the hairy and downy woodpeckers and the red-breasted nuthatch, have never been known to use any other type. On the other hand, Mr. Edward H. Forbush, after three years' trial of the Von Berlepsch type comes to the conclusion that most Massachusetts birds do not prefer them to the hollow kind or even to the rectangular box. But the only way of finding out is to put up the different types of houses, side by side, and see which the birds choose. This has been done by several men and the results in these cases were that most birds showed a preference for the plain-box type over the hollow-log type. This preference doubtless varies for different birds and possibly for the same species in different parts of the country.

So far as the author has been able to gather evidence on this question, the following seems a fair statement of the case at the present time: — Wrens, bluebirds, and tree swallows will occupy almost any convenient type, perhaps preferring the plain wooden box; the chickadee and flicker will probably select one type as quickly as the other, while other woodpeckers, such as the downy and the hairy, and the nuthatches, which have not occupied bird-houses so commonly, may prefer the hollow-log type. It



THREE TYPES OF NESTING-BOXES



OPEN NESTING-BOXES FOR ROBIN AND PHŒBE

is impossible to make any definite statement regarding this matter till a large number of experiments have been tried.

The following table shows the number of houses occupied on the author's place of about three acres, situated on the edge of a small city: —

	Von Berlepsch type (*6 boxes 1914*) (*6 boxes 1915*)		*Imitation on outside only* (*1 box 1914*) (*3 boxes 1915*)		*Plain-box type* (*8 boxes 1914*) (*7 boxes 1915*)	
	1914	*1915*	*1914*	*1915*	*1914*	*1915*
Bluebird	1					2
Flicker	1					
Red-headed woodpecker	1	1				
House wren	1	2	1	2	5	
Total for two years	7		3		7	
Per cent occupied	58		75		49	

Size and shape of house. The size of the house depends on the size of the nest made by the birds. The bottom of the box should be just large enough to accommodate the nest usually built by the bird. In the case of woodpeckers, which make no nests, the size of the house depends on the size of the bird.

A great variety of shapes may be employed. Some boxes have the long axis vertical, some horizontal, and others are nearly cubical in shape. Probably no one shape is best for all birds, but the box with the long axis vertical has one advantage, that it can be made practically cat-proof if it is built very deep,

has the entrance hole near the top, and has the roof project well out over the hole.

Size of entrance hole. Two features of the entrance hole are of great importance, its size and location. The size is important because this enables one to keep out larger birds than the one for which the house is intended. This is one successful way of keeping out the English sparrow from houses intended for the wren and the chickadee, and the starling from houses intended for these birds and for the bluebird and the tree swallow.

The smallest hole the English sparrow can enter is one and a quarter inches, and the starling one and three quarters inches. Thus a one-and-one-eighth-inch hole will exclude the sparrow and a one-and-five-eighths-inch hole the starling.

The birds may be classed in four groups according to the size of the hole needed: —

First group: small birds that can use a hole too small for the English sparrow, one and one eighth inches or less; chickadee, house wren, Bewick's wren, Carolina wren.

Second group: medium-sized birds that can use a hole too small for the starling, one and one fourth inches to one and five eighths inches; tufted titmouse, white-breasted nuthatch, downy woodpecker, bluebird, violet-green swallow, tree swallow, hairy woodpecker.

Third group: large birds that require an entrance

of two or three inches; house finch, crested fly-catcher, red-headed woodpecker, flicker, martin, saw-whet owl, screech owl, sparrow hawk.

Fourth group: extra large birds that require an entrance of six inches; wood duck and barn owl.

The size of the floor for the various groups should be about as follows: —

First group	4 inches square
Second group	5–6 inches square
Third group	6–8 inches square
Fourth group	10 x 18 inches

Location of entrance hole. A second important point about the entrance hole relates to its location. It should be near the top, except for the martins. This is for two reasons; first, it serves as a better protection from cats, and, second, it makes it necessary for the young to be well matured before they are able to climb to the hole and leave the box, and as a result they will be better able to care for themselves and to escape such enemies as the cat and the squirrel.

Movable covers for cleaning box. It is best to have all boxes made so that they can be easily opened. This is advantageous for two reasons: first, because, if the sparrows are using the house, their eggs may be taken out; and, second, because early each spring the house should be cleaned of the old nest and any other material that may be found there. In nature the birds' nesting-sites are not

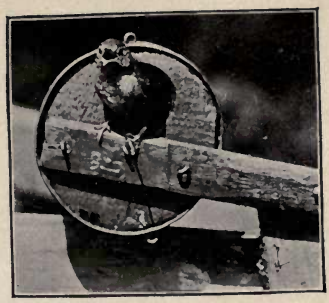
cleaned out, but observations that have been made of nesting-boxes seem to indicate that birds will more readily occupy a box that has no nesting-material in it. The construction of the nest is a part of the cycle of activities that goes with the period of reproduction, and doubtless it is best to give this nest-building instinct free play. The roof of the house can easily be fastened on by hinges and attached in front by a clasp.

Putting out the box. In putting out the box one needs to consider the following matters: (1) the time, (2) the location, (3) the height, (4) the method of fastening, (5) protection from enemies.

Time to put out. It is well to put the boxes out early. For some weeks before the birds seem to be ready to begin nesting, they are undoubtedly flying about searching for a site, and the houses, if placed out early, may induce some birds to stay of whose presence we might not otherwise have had the least intimation. By putting the houses out early, they will also become more weather-beaten and lose something of their new appearance. Some birds rear two broods, as the wren and bluebird, in which case the box may be occupied by the second brood, even if it is not placed out till late in the season.

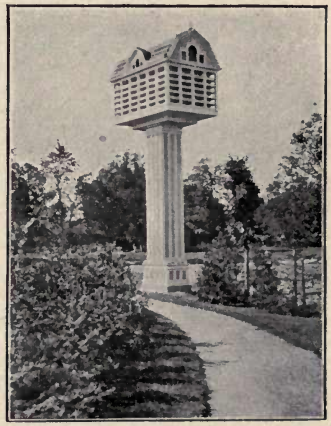
In the case of the martin-house, if it is kept up all the year, it is well to cover the holes till the martins return in the spring, so as to keep out the sparrows. And likewise with the other houses, when

BLUEBIRD AT ENTRANCE TO NESTING-BOX



HOUSE WREN AND TOMATO-CAN HOUSE

TREE SWALLOW AT NESTING-BOX



MARTIN-HOUSE

Accommodating five thousand birds

the sparrows begin nesting in them very early, the holes may be covered till time for the native birds to return.

Houses for woodpeckers should have a small amount of a mixture of dry dirt and sawdust placed in them to take the place of the peckings of wood that the birds leave in their holes.

Location of box. The location of the box is important. Very few birds will occupy a box in the dense woods, so that boxes should not be placed in heavy shade, but should be well exposed. Boxes may be placed on grape arbors and trees in the yard, and even on porches. Telephone-poles furnish good locations. Experiments that have been made seem to indicate that birds prefer a house placed on a post to one placed on a tree and that they prefer houses in the open or light shade to those in the dense shade.

Mr. Edward H. Forbush, State Ornithologist of Massachusetts, in his annual report for 1915 gives the results of his experiments with nesting-boxes during the past season. Twenty-five boxes were erected on poles in the open, and fifty boxes on trees. A census taken on July 4 showed that of the houses on poles ninety-six per cent were occupied by birds (including one pair of English sparrows; the other sparrows were driven away by removing their eggs); while of the boxes on trees only eight per cent were occupied. Mr. Forbush also cites the case of another man who mounted twenty-one nesting-boxes

on short poles on the posts of his pasture fences, of which eighteen boxes, or eighty-six per cent were occupied. For three years the author had a nesting-box placed at the edge of the woods, during which time it was unoccupied. In the spring of 1915 this was taken down and placed on a post supporting a martin-house. Within two days it was occupied by a pair of bluebirds. These results all point strongly to the conclusion that more boxes will be occupied if they are put on posts in the open than if put on trees. Although the author has had many houses occupied that were placed on trees, in most cases these were isolated trees standing in the yard. Boxes put up in the woods and on trees are more apt to be occupied by such enemies of the birds as squirrels.

Martins prefer their houses out in the open at some little distance from trees or buildings.

Height. Excessive heights should be avoided. in general birds prefer medium heights, from eight to twenty feet. The details for the different birds are given in the table on page 243.

Method of fastening. The house should be fastened so that it is secure against the winds, but so that it can be taken down easily without injuring the box. Some have a screw-eye or loop of wire which can be placed on a hook; others have a hole in the back which will fit over a nail; others have an extension of the back at the top and bottom by

which they can be nailed or screwed up; and still others are suspended so as to swing in the wind.

When houses are put up on posts, the posts may be jointed near the ground so that they can easily be taken down. This may be done by setting into the ground a short post projecting a few feet above the surface, and fastening to this the post on which the box is placed. The two posts may be fastened together by means of a large hinge and clasp, or by joining the two posts by two long bolts. When it is desired to take down the house, one bolt may be removed and the post rotated around the other. If the house is heavy, as for the martins, two posts may be driven into the ground and the other post fastened between them.

Protection from the cat. Two enemies of our native birds are unfortunately very common, the cat and the English sparrow. The birds can be protected from the cat to some extent, in the construction of the house, if this is made deep with the entrance hole placed near the top and with the roof projecting well out over the entrance. Still further protection may be given after the house is put up. A piece of zinc or tin about two feet wide may be wrapped around the tree or post below the box and fastened at such a height that the cat cannot leap above it from the ground. It is unable to climb over this. If boxes are placed on slippery poles, cats seldom climb them. A method used on the Ford

farm is to fasten the boxes to the top of posts by means of iron bands about two feet long. Several of the dealers mentioned at the close of this chapter advertise cat guards that may be put around posts or trees.

Protection from the English sparrow. Various devices have been tried in the construction of the house and the method of putting it out, to protect birds from the sparrow. Of these devices the author knows of only one which is always successful; that is to make the hole so small (one and one eighth inches or less) that the sparrow cannot enter, but large enough for small birds such as the wren and chickadee. Other devices which have been suggested, such as leaving off the perch from the house and suspending the house so that it can move, are not universally successful. In the author's experience they have proved of little value. He has found that the sparrows do not use the moving houses as often as the stationary houses, but they do use them in about the same proportion as the other birds, so that little is gained in suspending the houses.

If the sparrows begin to use a box, the eggs can be removed every week or two and thus the birds may be prevented from raising young, at least, and sometimes the sparrows will leave and thus give an opportunity for other birds to use the box. On May 26, 1915, Mr. E. H. Forbush found in twenty-five of his nesting-boxes, ten tree swallows' nests, ten

English sparrows', and two bluebirds'. Shortly after this the eggs of the sparrows were removed and no more eggs were laid, although a new nest was built. On July 4, there were twenty swallows' nests, three bluebirds', and one English sparrow's. So that as a result of removing the sparrows' eggs the number of native birds using the boxes was about doubled. But the only final solution of the problem seems to be to kill the sparrow either by shooting or by trapping, as explained in Chapter XIV.

The most essential points to consider in making bird-boxes may be briefly summarized as follows: (1) the size of the entrance hole, which should be of the right size for the bird desired; (2) the location of the box, which should be on posts in the open rather than on trees in the shade; and (3) the protection of the boxes from the birds' enemies, especially, the cat, the English sparrow, and the squirrels. Of secondary importance are the following points; material of which made, size, shape, type, height put out, and direction in which the entrance hole faces.

Open houses. There are some birds which do not nest in cavities, that will, however, build nests in shelters having open sides. Birds which have been reported as using these shelters are listed on page 227.

For the catbird, song sparrow, and brown thrasher the shelter should be open on all four sides and placed in shrubbery where these birds nest.

OPEN SHELTERS

Name of bird	*Kind of shelter*	*Floor (inches)*	*Height (inches)*	*Height above ground (feet)*
Robin	One or more sides open	6 x 8	8	6 to 15
Phœbe	One or more sides open	6 x 6	6	8 to 12
Barn swallow	One or more sides open	6 x 6	6	8 to 12
Song sparrow	All sides open	6 x 6	6	1 to 3
Brown thrasher	All sides open	7 x 9	8	1 to 3
Catbird	All sides open	6 x 8	8	3 to 10

A shelter with the front and two ends open may be placed where robins and phœbes naturally nest, and sometimes simple shelves placed in appropriate situations are used by these birds.

A shelter with the front and one side open, if placed under the eaves of a barn, may be occupied by barn swallows.

Some of the important points to consider in the building of a box for a particular bird are given for convenience in the accompanying tabular form, which is taken, with some changes, from Farmer's Bulletin No. 609, "Bird-Houses and How to Build Them." These are arranged in the order of the size of the entrance, the smallest first.

NESTING-BOXES

	Name of bird	Diameter of entrance (inches)	Floor of Cavity (inches)	Depth of Cavity (inches)	Entrance above floor (inches)	Height above ground (feet)
Sparrow-proof	House wren	1	4 x 4	6 to 8	4 to 6	6 to 10
	Bewick's wren	1	4 x 4	6 to 8	4 to 6	6 to 10
	Vigors's wren	1	4 x 4	6 to 8	4 to 6	6 to 10
	Carolina chickadee	1	4 x 4	6 to 8	4 to 6	8 to 10
	Carolina wren	1⅛	4 x 4	6 to 8	4 to 6	6 to 10
	Black-capped chickadee	1⅛	4 x 4	8 to 10	6 to 8	6 to 15
	Parkman's wren	1⅛	4 x 4	6 to 8	4 to 6	8 to 10
Starling proof	Tufted titmouse	1¼	4 x 4	8 to 10	6 to 8	6 to 15
	White-breasted nuthatch	1¼	4 x 4	8 to 10	6 to 8	12 to 20
	Downy woodpecker	1¼	4 x 4	8 to 10	7 to 9	6 to 20
	Bluebird	1½	5 x 5	8 to 10	6 to 8	5 to 10
	Violet-green swallow	1½	5 x 5	6	4 to 5	10 to 15
	Tree swallow	1½	5 x 5	6	4 to 5	10 to 15
	Hairy woodpecker	1½	6 x 6	12 to 15	10 to 12	12 to 20
	House finch	2	6 x 6	6	4	8 to 12
	Crested flycatcher	2	6 x 6	8 to 10	6 to 8	8 to 20
	Red-headed woodpecker	2	6 x 6	12 to 15	10 to 12	12 to 20
	Flicker	2½	7 x 7	16 to 18	14 to 16	6 to 20
	Martin	2½	6 x 6	6	1	15 to 20
	Saw-whet owl	2½	6 x 6	10 to 12	8 to 10	12 to 20
	Sparrow hawk	3	8 x 8	12 to 15	10 to 12	10 to 30
	Screech owl	3	8 x 8	12 to 15	10 to 12	10 to 30
	Barn owl	6	10 x 18	15 to 18	4	12 to 18
	Wood duck	6	10 x 18	10 to 15	3	4 to 20

Martins. Martins prefer to nest in colonies, so that houses should be provided which contain a number of compartments. Each dimension of a single room should be about six or seven inches. The

entrance hole may be either square or circular, and should be about two and a half inches across. The best height for erecting the house is from fifteen to twenty feet, although houses placed much higher have been used. To prevent the English sparrow from getting established early in the spring, the house may be taken down in the fall and put up again in the spring. This may be easily done if the pole is put up as suggested on page 239. Directions for making a simple house out of a barrel are given in Mr. E. H. Forbush's "Useful Birds and Their Protection." This type of house has been adopted by the Meriden Bird Club.

Most birds will use a hole which just permits them to enter, but the martin prefers a hole large enough to admit light while it is entering, so that while it could just enter a one-and-five-eighths-inch hole, the openings in martin-houses are made about two and one half inches in diameter. As it seems probable that starlings may drive martins from their houses, it has been suggested that the hole be made small enough (one and five eighths inches) to exclude the starling and that a small hole about one half inch in diameter be bored above the entrance to admit light while the bird is entering.

Providing nesting-material. There are still other birds, which, while they will not allow us to choose the exact site of their nest for them, may sometimes be induced to nest in our immediate vicinity if some

MR. FORBUSH'S SCREECH OWL IN NESTING-BOX

materials which can be utilized in the construction of the nest are put in a conspicuous place which is easily accessible. An examination which the author made of a collection of nests showed that twenty-one species used materials provided for them by man. Horsehair was used by eleven species, strings by seven, mud by four, paper by three, cloth by two, and feathers by two. The Baltimore oriole uses a large amount of such materials as string and yarn; the chipping sparrow nearly always lines its nest with horsehair; robins commonly use pieces of cloth; vireos, the wood pewee, the least flycatcher, and the kingbird may line their nests with cotton batting.

Material to be exposed. Some of the materials which may be exposed on fences, bushes, trees, etc., are the following: yarn, string, thread, rags, horsehair, straw, tufts of cotton and wool, small strips of cloth, pieces of grapevine bark, feathers, cotton batting, and shoemakers' flax. This flax is a good substitute for the plant-fibers which many birds use. The yarn and strings should be of a somber color, and should be cut into lengths of not over twelve inches, lest the birds become entangled and hang themselves. If any of this material is taken by the birds, it furnishes opportunity for locating the nest, so that it may be watched and such means taken as may be necessary to protect the occupants. During dry seasons, if pans of mud are set in easily accessible and protected places, they may be found and

used by such birds as the robin, barn swallow, and phœbe.

Results. As one example of what results one may expect, the table on page 233 shows the results on the author's place for the years 1914 and 1915.

Mr. Neil M. Ladd, of Greenwich, Connecticut, reports that on his place of ten acres there were but twelve nests representing four species when he first began to take steps to increase the birds around his home. As a result of four years' efforts, the number was increased to seventy-five nests representing twenty species.

Mr. Edward H. Forbush, in his annual report for 1915, writes that within an area of eight acres on his farm, during the season of 1915, one hundred and twenty-six young birds were reared, representing four species, where prior to 1914 not one bird of any of these species was reared, or could have been reared, as there were no nesting-places for them.

Dealers in apparatus to attract birds. One of the most interesting developments during the past five years has been the appearance of a large number of dealers who advertise for sale various types of appliances for attracting birds. The appearance of these dealers indicates that there is a widespread interest in birds and a demand for these appliances. Below is given a list of the dealers whose advertisements the author has seen. All publish circulars which may be had on application.

The following abbreviations are used to indicate the nature of the apparatus for sale by each dealer:

(N = nesting-boxes; M = martin-houses; W = winter feeding devices; F = fountains; S = sparrow-traps; C = cat-traps.)

American Column Company, Battle Creek, Michigan. N.

The Audubon Bird-House Company, Meriden, New Hampshire. N; W; F; C.

Chicago Birdhouse Company, 624 South Norton Street, Chicago. N; M; W; F; S; C.

Albert Crescent, Thom's River, New Jersey. N; M; W; S.

Joseph H. Dodson, 701 Security Building, Chicago. N; M; W; F; S; C.

Henry A. Dreer, 714 Chestnut Street, Philadelphia. N; M; W; F; S.

Electric Fountain Co., 348 G West 42d St., New York City. F.

Farley and Loelscher Manufacturing Company, Dubuque, Iowa. N; M; W; S.

Garden Unique, 3163 Iveson Ave., Berwin, Ill. N.

Greenwich Bird Protective Society, Greenwich, Connecticut. N; W; S; C.

Holm & Olson, 20 W. Fifth St., St. Paul, Minn. N; W; F.

Ideal Bird-House Company, New Windsor, Maryland. N; M.

Jacobs Bird-House Company, Waynesburg, Pennsylvania. N; M; W; S.

Jersey Keystone Wood Co., Trenton, N.J. N; W.

Louis Kuertz, Route 2, Loveland, Ohio. N; M; W.

Lansing Company, Lansing, Mich. N.

Liberty Bell Bird Club, "Farm Journal," Philadelphia. N; M; W; S.

H. B. Logan, Montevideo, Minnesota. N; M.

Maplewood Biological Laboratory, Stamford, Connecticut. N; M; W; F.

Matthews Manufacturing Company, Williamson Building, Cleveland, Ohio. N; M; W; F; S.

Henry F. Mitchell, 518 Market Street, Philadelphia, N; M.

Neighorhood Craft, Locust Valley, Long Island, N.Y. N; M; W.

Winthrop Packard, Canton, Massachusetts. N; M; W.

Philip E. Perry, P.O. Box 2275, Boston, Massachusetts. N.

Pinedale Bird-Nesting-Box Company, Wareham, Massachusetts. N.

Rookwood Pottery Co., Cincinnati, O. F.

Sharonware Workshop, 42 Lexington Avenue, New York City. F.

Simplex Bird Apparatus Company, Demarest, New Jersey. W.

West Chester Bird-Box Company, West Chester, Pennsylvania. N.

Wheatley Pottery Company, 2426 Reading Place, Cincinnati, Ohio. N; F.

Charles E. White, Box 45, Kenilworth, Illinois. N; W.

Whip-O-Will-O Furniture Co., 352 Adams Ave., Scranton, Pa. N; W; F.

CHAPTER XX

FEEDING THE WINTER BIRDS

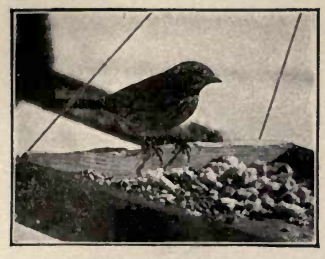
During the winter season the opportunity offered for studying birds, at a time when nature's activities are at their lowest ebb, is most welcome, and especially so because the birds may become so tame that they will feed from the window-sill while one is sitting just inside the window, thus affording opportunity to observe them at close range.

Value to man. There is also a great practical value in attracting the birds around the farm and garden that they may feed upon insects' eggs and hibernating insects and remain in the spring to attack the newly hatched caterpillars.

A very instructive experiment was tried by Mr. Forbush in Massachusetts. An old neglected orchard was selected, and during the winter special effort was made to attract the birds by means of suet and other foods. By this means nuthatches, chickadees, woodpeckers, and creepers were attracted to the orchard, remaining during the winter months. Observations of the feeding-habits and examination of the stomach-contents of a few chickadees showed that they were eating large numbers of eggs of the fall canker-worm moth, and the larvæ and pupæ

of other injurious insects. In the spring, when the female canker-worm moths appeared in the orchard the chickadee fed on these. While the trees in the neighboring orchards were badly infected with the worms, comparatively few were found in the orchard which had been frequented by the winter birds, and the few which did appear were easily disposed of by the summer birds which came to the locality. The trees in other orchards were almost stripped of their foliage, while this one retained its leaves, and, with one exception, was the only orchard in the neighborhood to produce any fruit. It should be noted that the exception was the nearest orchard to the one on which the experiment was tried.

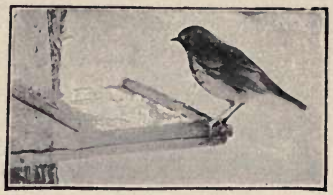
Need of feeding birds in winter. The winter is a season when, from the bird's standpoint, assistance in obtaining food is particularly welcome. When heavy snows lie on the ground, much of the supply of the seed-eating birds is hidden; and when the tree-trunks are covered with ice, insect-eating birds find it difficult to break through this coating, to secure insects and their eggs in the bark beneath. Under ordinary conditions our birds can withstand quite cold weather if they are well supplied with food; but their food is digested so quickly that birds require a large amount of it and frequent access to it. Birds may also perish from exposure to severe storms and weather, as well as from starvation, so



SONG SPARROW

DOWNY WOODPECKER

CHICKADEE



HERMIT THRUSH

A BIRD'S TEPEE

Made of bean-poles with the vines still attached

SELF-SUPPLYING FEED BOX

that shelter as well as food is necessary to protect the winter birds.

Birds to expect. The success of winter feeding and the kinds of birds one may expect to come and feed vary with the locality and with the season. In general more birds will visit feeding-stations in the Northern States, where the severe storms cover their natural food-supply, than in the Southern States, and one may expect more birds during a severe winter with heavy snows than in a mild winter with little snow.

From a number of reports recorded in "Bird-Lore" and elsewhere, including forty-five observers, representing fourteen States, situated chiefly in the northeastern section of the country, the author has made a brief summary of the birds known to eat food put out for them. This includes forty-nine species of birds of which the ten most common in the order of frequency are the chickadee, white-breasted nuthatch, downy woodpecker, blue jay, junco, hairy woodpecker, tree sparrow, red-breasted nuthatch, brown creeper, and song sparrow.

Feeding from the hand. With the exercise of a little patience there is the possibility, not only that birds will come to the window to feed, but that they will soon feed out of one's hand. Of the forty-nine species of birds previously mentioned as using food provided for them, twenty-nine have become sufficiently tame to feed from a window shelf, and thir-

teen have fed from the hand. Those reported as feeding from the hand, arranged in the order of the number of records, are the chickadee, red-breasted nuthatch, white-breasted nuthatch, redpoll, tufted titmouse, Oregon jay, Canada jay, evening grosbeak, bluebird, chipping sparrow, pine grosbeak, white-winged crossbill, and pine siskin.

Kinds of food. As far as possible one should put out the kinds of food which birds prefer; but in times of great hunger birds will eat many foods which under ordinary circumstances would not be attractive to them. Birds may be divided into two groups according to their food habits, seed-eating and insect-eating, although many birds eat both seeds and insects. But this suggests that we may seek to find substitutes for these two classes of natural food. Without question the best food for insectivorous birds is suet. It is cheap, does not freeze easily, and is eaten by many birds.

The seed-eating birds live largely on weed seeds in nature, but many other kinds of seeds are relished by them. Among the best are hemp, sunflower, millet, and peanuts. Other foods which have been eaten by birds are: crumbs, cracked corn, fat pork, dog-biscuits, oats, oatmeal, squash seed, nuts, marrow of bones, wheat, and boiled rice.

The food should be supplied with regularity, particularly so during stormy or severe weather, so that the birds may be able to find a supply at all

times. Care should be taken, in the use of such foods as decay or sour easily, to see that the spoiled food is removed and a fresh supply provided; at times it may be well to supply water.

Methods of putting out food. Food may be put out in a great variety of ways: (1) on the ground, (2) on shelves, (3) fastened on limbs of trees, (4) in suet baskets, (5) on old Christmas trees, (6) in an automatic hopper, (7) in an Audubon food-house, (8) in a weathercock food-house, (9) in a window box, and (10) on a moving counter.

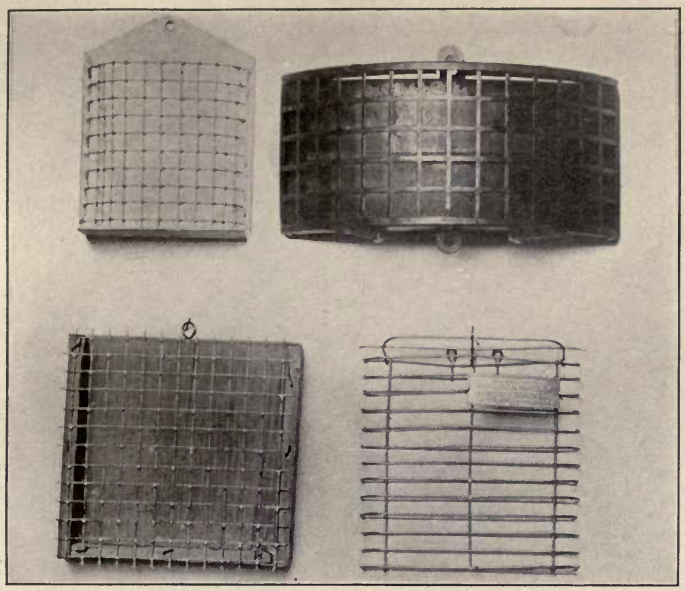
On the ground. To supply seed-eating birds, a bit of ground may be swept clear of the snow, or the snow trampled down, and chaff, crumbs, and the various kinds of grain and other seeds scattered there. To this may come such birds as the sparrow, junco, snow bunting, blue jay, and quail. This food may be protected by means of boards placed over it in the form of an "A." A large brush-heap, covered well with evergreen boughs, with grain thrown under it, does very well.

Shelves. Various kinds of shelves may be used. In its simplest form a shelf may consist of a board attached to a tree, with a narrow strip around the edge to prevent the food from being blown off. This may be placed at first at a little distance till the birds become accustomed to coming to it, and then brought nearer to the house; or it may be placed on the top of a short post.

Window shelf. The shelf may be placed at a window, and many birds will become so tame that they will feed here, even when a person is sitting by the window inside. This shelf should be wide, so as to allow room for a number of birds to dine at once. If covered with burlap, the small seeds and crumbs will blow away less easily. It would doubtless be worth while to arrange some kind of awning or roof over this to keep off the snow, so that the birds might be able to find food during the storms.

Suet-box. Suet may be tied to branches of trees, or a suet-box, adapted for hanging on a tree, can be easily made. A piece of half-inch board about five by six inches forms the back. Around this on the two sides and across the bottom are nailed strips of narrow half-inch boards, about two inches wide. Across these strips is fastened a piece of poultry-wire netting with one-inch mesh or a piece of hardware cloth. The top of the box is left open for inserting the suet. A screw-eye is screwed into the top of the back so that the box may be suspended from a nail driven into a tree. This prevents the birds from carrying off large pieces of suet and wasting it, but enables them to feed through the meshes. Suet-baskets may be bought of several of the dealers listed in Chapter XIX.

Christmas tree. After the Christmas season is over, instead of throwing away the tree, it may be loaded with food for the birds. Suet and berries may



SUET-BASKETS

One in lower left-hand corner made by fifth-grade boy in manual-training department

RED-BREASTED NUTHATCH

WHITE-BREASTED NUTHATCH

be fastened to the branches and bags containing seeds and nuts may be suspended. This tree may be fastened upright in the yard or the small tip may be placed on a window shelf.

Automatic hopper. Several automatic feeders on the principle of poultry hoppers are now for sale on the market, or they can be easily made. The large hopper can be filled with seeds, which come out of a small opening at the bottom leading to a shelf. As fast as the seeds are used, others fall down to take their place. When once filled this may last several weeks.

The Audubon food-house. A modification of the Von Berlepsch food-house has been made by Mr. Frederic H. Kennard in this country and has been widely and successfully used. This consists of a post from five to six feet above ground and three feet in the ground. A rustic appearance is given by using a stout post with the bark on, such as red cedar. The house consists of a square hip roof two feet, ten inches over all, and supports beneath it four glazed sashes, two feet long by ten and one half inches high, and jointed at the corners. It is fastened to the post by means of a wooden block two inches thick, attached beneath the apex of the roof, with a hole in the center, into which the top of the post is driven and nailed. There are two food shelves fastened about the post, an upper one, twelve inches in diameter on a level with the bottom

of the sash, and a lower tray, eight inches in diameter placed about ten inches lower. This lower one is used to attract the attention of the birds to the upper one, where most of the food is kept. In the sashes are fastened pieces of glass.

The advantages of this food-house are, first, that the birds are protected from storms; second, that they are protected from cats; and third, that the glass allows one to watch the birds inside as well as throwing light on the food.

Weathercock food-house. The weathercock food-house consists of a box open on one side and so arranged on a pivot that it is easily turned by the wind by means of long vanes projecting back. The front may be made of glass. Whichever way the wind blows, the house turns so that the open side is away from the wind. Sometimes the ends are made of glass also. This enables one to see the birds feeding there. This house has been tried by the Meriden Bird Club and found to work satisfactorily.

Window box. The window box was suggested by Mr. William Dutcher and was worked out by Mr. Baynes at Meriden. This consists of a frame that fits under the open window and projects into the room, the top, sides, and back being of glass. At the top is a hinged door through which food may be passed. Mr. Baynes reports this as being very successful.

Moving counter. One of the most satisfactory plans which the author has tried is a shelf moving

on a wire. The details of this have been worked out very ingeniously by Edward Uehling, who, at the time this work was done, was a boy in the eighth grade of school. The author was closely associated with him in this work and tried a similar device at his own home. Some of the most successful results of which the author has known followed from this plan as worked out by his friend during the winter of 1906 and 1907. A wire was put up, sloping from a second-story window to a tree about forty feet distant. On this wire the lunch counter was suspended by means of two pulleys set in a frame. To this frame a string was attached and run to the window. The slope of the wire carried the counter toward the tree, so that it could be kept in any desired position along the wire. On this were placed suet, nuts, sunflower seeds, and other foods. At first this was allowed to remain out at full length of the wire, touching the tree. Tree-climbing birds soon found this and came regularly to feed upon it. After the birds had become accustomed to coming to the counter in this position, it was drawn up a little nearer each day, till at the end of a month it had been pulled to the window. Those birds which at first came to it continued to do so even when it was brought up near enough to touch the window. The following winter a roof was placed over the trough, which partially prevented the food from being covered by snow during storms.

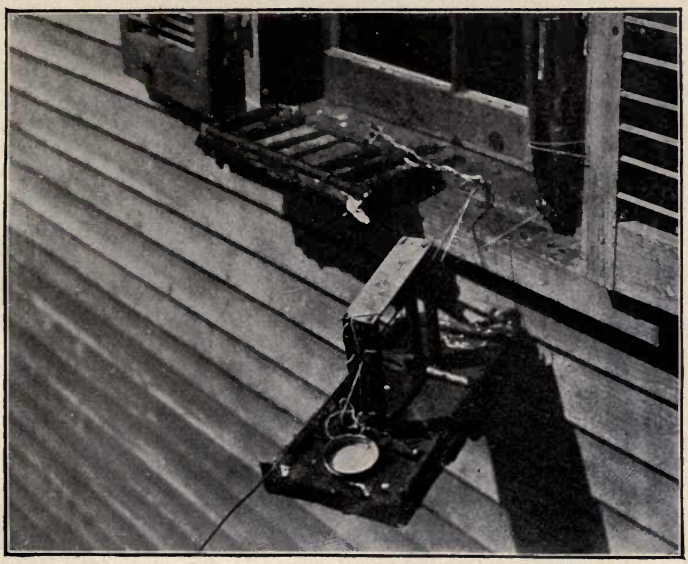
On one cold day when the snow was deep, the author and Mr. Uehling watched the birds from within the window from 6 A. M. to 5 P. M. The first birds came at 6.42 and the last at 4.23. Eight species of birds visited the counter, including the chickadee, the junco, the white-breasted nuthatch, the blue jay, the hermit thrush, the downy woodpecker, the English sparrow, and the brown creeper (arranged in the order of the number of visits made). A total number of two hundred and two visits were made, or an average of twenty per hour. All the birds at some time during the day, except the sparrow and the creeper, came to the window shelf or the moving counter. The downy and the creeper ate only suet, and the junco and the sparrow only bread crumbs.

Difficulties. The same two difficulties confront us here as in providing nesting-houses — the cat and the English sparrow. The birds may be easily protected from cats by wrapping a piece of tin or zinc around the tree below the food; by putting the window shelf at a second-story window; or by suspending the counter from a wire as explained on page 257.

English sparrows. The sparrow problem, however, is not so easily solved. In one way the difficulty is not so acute as with the nesting-houses, where two birds cannot occupy the same apartment; for it is possible to furnish food both for the spar-

SHELTER FOR BIRDS' FOOD

Fifteen birds feeding, — song sparrows, tree sparrows, juncos



WINDOW AND MOVING FOOD-SHELVES

rows and other birds; but as a matter of fact experience shows that where the sparrows congregate in large flocks, as is their custom, the other birds keep away. The author's experience suggests that a moving counter tends to keep the sparrows away, as they will not visit it so frequently as the stationary shelf, and only when driven to it by lack of food elsewhere; on the other hand, our native birds come to it readily.

CHAPTER XXI

FOUNTAINS AND SHRUBS FOR THE BIRDS

Fountains

Essentials of fountains. Birds use water for two purposes, for drinking and for bathing. In constructing a fountain which will be adapted to both of these purposes, three essentials should be kept in mind; first, the edge and bottom should be of roughened material, so that the birds will not slip; second, the water should be shallow, two and a half to three inches is deep enough for most birds; third, the bottom of the fountain should slope gradually from the edge out to the center, so as to give a gradual change in the depth of water.

Location. In deciding upon the location, the important matter to consider is protection from cats. Birds fly with difficulty when their feathers are wet, and thus are easily caught. Fountains may be raised on pedestals as a protection from cats, or set in the middle of a lawn with no bushes near behind which cats may hide; or probably the best solution is to look after the cats and place the fountain near shrubbery where it will be partially shaded, and other plants may be put around it for an ornamental setting.

Pans for fountains. Simple and effective bird-baths may be made of almost any shallow receptacle, such as large flower-pot saucers, pans of various kinds, wash-boiler covers, etc. Sand and gravel should be placed in these so as to give a range in depth of water from a half-inch or less at the edge to about three inches in the center; or shelving rocks may be placed in the basin; these would render easier the change of water, which should be renewed each day, and would furnish a better standing-place for the birds than the smooth edge of the pan. The pan may be fastened in a crotch of a tree, or placed on a post or window-sill, high enough to be out of the reach of cats. It is preferable to place it where it will be partially shaded to prevent the water from becoming warm.

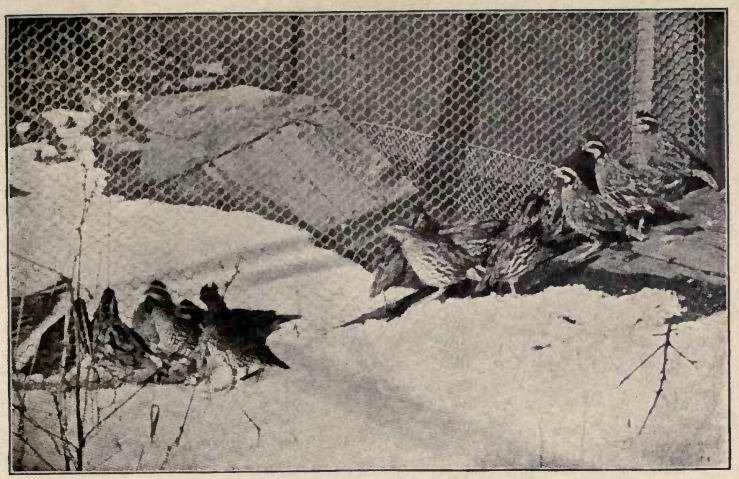
Concrete fountains on the lawn. One of the most satisfactory types of fountain is one made of concrete sunk in the ground. To make this, a hole about three feet across is dug out, gradually sloping from the edge to a depth of five or six inches in the middle. This is plastered over with a mixture of Portland cement and sand, in the proportion of one to four, thick enough to leave the center about three inches deep and to slope gradually from there to the edge. If the water leaks through too rapidly, another thin coating may be placed over this, made by mixing about equal parts of sand and cement.

This may be located near shrubbery where it will

be partially shaded, and various plants, such as ferns, may be grown around it. If one has no access to running water, the fountains may be cleaned out once or twice a week with a broom. This frequent cleaning will prevent mosquitoes from breeding. If one has a supply of running water, this can be let in at one side and out at the other. The overflow can be disposed of by digging a hole several feet deep and filling with rocks, into which the drain-pipe can be led. This may then be covered with turf.

Some members of the Meriden Bird Club use a fountain made of zinc, which contains a succession of five or six broad steps about one half-inch high and seven inches wide, thus giving a range of from one half to three inches in depth. This may also be made with the bottom gradually sloping from one end to the other.

Visitors at fountains. The number of birds that visit a fountain during a season may be very large. The number that will occupy bird-houses is comparatively small, limited by the natural nesting-habits of the birds; the number that may be attracted by winter feeding is larger, but still limited to those birds which have the ability to withstand cold weather; the number that may be attracted by fountains is still larger, as there is the possibility of enticing birds from the three great groups of transient visitants, summer residents, and permanent residents. One observer reports that sixty-



BOB-WHITE REARED IN CAPTIVITY

CONCRETE BIRD FOUNTAIN ON THE AUTHOR'S LAWN

nine different species of birds — many rare warblers and migrants among them — came in one season to drink from a basin on a suburban lawn. Another observer reports seeing fifteen kinds of birds around his fountain in one afternoon. Mr. E. H. Baynes writes that twenty-two species of birds have visited his fountain.

Trees, Shrubs, and Vines

Planting for the birds. For one who owns a farm, or a place with fair-sized grounds, on which he expects to live for a number of years, perhaps no greater returns in bird life will be given than from a proper planting of trees, shrubs, and vines. A treeless and shrubless locality means a more or less birdless locality. These are essentials to furnish nesting-sites and shelter for most of our common birds. These plantings may serve a fivefold purpose — to furnish shelter, nesting-sites, and food for the birds, to protect cultivated fruit from the birds, and to beautify the home grounds.

Planting for shelter. While all trees furnish some shelter for the birds, the coniferous trees are especially valuable for this purpose on account of the retention of their foliage during the cold months, which furnishes some protection against the winter storms and serves as a favorite roosting-place during the long, cold nights. Windbreaks of any kind of trees may also serve as a shelter. The smaller plants, too,

such as tangles of shrubs and vines, furnish retreats for many of the smaller birds when pursued by hawks; and serve as a shelter for winter birds.

Planting for nesting-sites. While occasionally some birds seem to show a preference for some particular kind of tree or shrub in which to place their nests, usually it is a question of the general locality, with its surroundings and the food and protection given, which decides the bird in its selection of a nesting-site. Hence those plants which will best serve the purpose of food and shelter will also furnish nesting-sites. A number of trees and tangles of shrubbery, thickly overgrown with vines, furnish the needed conditions for nesting-sites, provided the other factors are favorable. If hedges are substituted for fences, they may furnish nesting-sites and at the same time serve as a means of ornamentation.

Planting for food. In selecting plants the question of food should receive first consideration. Some of our birds feed quite largely on fruits in their season, and a large number of them select fruits as a small part, at least, of their diet.

The birds which feed to a considerable extent on wild fruit are arranged in the following table in the order of the percentage which this forms of their whole food. These figures are taken from the reports of the United States Bureau of Biological Survey:—

Name of bird	*Per cent that wild fruit forms of total food*	*Number of kinds of fruit known to be eaten*
Cedar-bird	74	20
Bob-white	47	20
Robin	42	32
Catbird	33	15
Ruffed grouse	28	23
Fox sparrow	28	6
Yellow-bellied sapsucker	26	17
White-throated sparrow	25	12
Cardinal	24	20
Flicker	20	28
Rose-breasted grosbeak	19	12
Bluebird	18	23

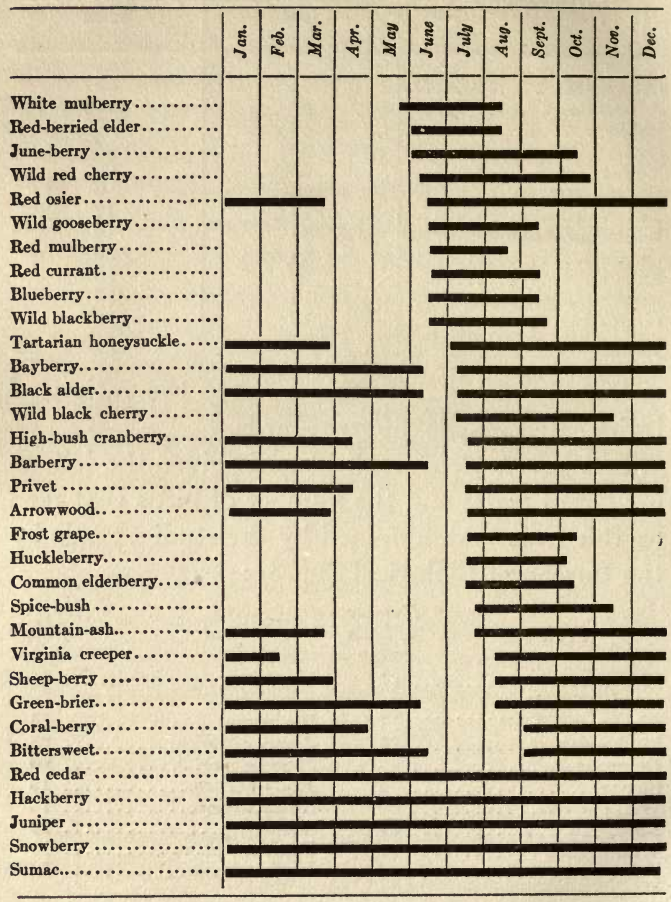
A study of the last column shows the variety of fruits eaten by the different birds.

In a government publication is given the following list of fruits and the number of birds that feed on this fruit as determined by the studies made by the Bureau of Biological Survey: —

Fruit	*Number of birds eating*	*Fruit*	*Number of birds eating*
Elder	67	Virginia creeper berries	25
Raspberries / Blackberries	60	Bayberries	25
Mulberries	48	Juniper berries	25
Dogwood	47	June-berries	20
Sumac	44	Holly berries	19
Wild cherries	39	Strawberries	16
Blueberries	37	Viburnum	16
Wild grapes	29	Hackberries	15
Pokeberries	26	Huckleberries	15

Succession of fruits. The accompanying table, on page 266, is taken from a publication of the Bureau

TABLE OF FRUITING-PERIODS



of Biological Survey, with a few omissions and a change in the order. These plants are arranged in the order in which the fruit begins to ripen, so that from a study of this table one may select shrubs which will furnish the birds with a succession of food from spring through summer and fall, and even through winter, as the fruit of several shrubs remains during most of the winter season. The period of the fruiting-season is taken from the earliest and latest dates recorded for New York and New England, so that an individual plant would not remain in fruit during all of this period.

Mr. Frederic H. Kennard, in Baynes's "Our Wild Bird Guests," suggests the following species as among the best for providing birds with a continuous supply of food throughout the year: —

	Trees	*Shrubs*	*Vines*
Summer	White mulberry Red mulberry Bird cherry (*Prunus pennsylvanica*)	Shad-bush Blue cornel Tartarian honeysuckle Red-berried elder	
Autumn	Flowering dogwood White thorn Bird cherry (*Prunus serotina*)	Silky cornel Gray cornel Arrowwood Withe-rod Common elder	Frost grape
Winter	Gray birch Cockspur thorn European mountain-ash Siberian crab-apple	Barberry Black alder Common privet Buckthorn Sheep-berry Black haw	Virginia creeper Summer grape

	Trees	*Shrubs*	*Vines*
Spring	Washington thorn American larch European larch Flowering crab-apple	Japanese barberry Non-poisonous sumac Highbush cranberry Wild rose *Rosa multiflora*	False bittersweet Boston ivy

Most desirable fruits. It is a matter of quite common observation that, on the whole, the best single tree to plant is the mulberry. It begins to bear early and its fruiting season is well prolonged. Other especially attractive fruits are the Juneberry, elderberry, and wild cherries. A study of the table on page 265 will suggest others of the most desirable plants.

Herbaceous plants. There are also some herbaceous plants which can be grown to attract birds. A row of sunflowers at the back of the garden is often visited by goldfinches or others of the finch family. Goldfinches also eat the seeds of the blue cornflower. The hummingbird is attracted by bright flowers with deep tubes. Either red or orange flowers are preferred. Some of its favorite flowers among wild plants are coral honeysuckle, painted-cup, columbine, jewel-weed, Oswego-tea, and cardinal-flower; and among cultivated flowers, columbine, scarlet salvia, bee-balm, nasturtium, and gladiolus.

Planting for ornamentation. The plants which are set out to attract the birds may also serve the

purpose of ornamentation. Among our vines the Virginia creeper, which is a favorite among the birds, is very attractive because of its decorative effect. Shrubs may be chosen which hold their berries during the winter, thus furnishing the birds with food when it is especially welcome, and also adding greatly to the winter landscape by their bright and attractive colors. Some of the shrubs which carry their fruit through a part or the whole of the winter are holly, bayberry, mountain-ash, black alder, greenbrier, red cedar, sumac, hackberry, bittersweet, and burning bush.

Reference has already been made in Chapter X to the planting of shrubs and trees to protect cultivated fruit.

Calendar for attracting birds

March–April.

Continue to keep out food as suggested for October–February.

Put out nesting-houses.

Clean out the old nesting-houses.

Put a little sawdust in boxes intended for woodpeckers.

Set out shrubs to attract birds.

May.

Plant seeds of sunflower and gourds.

Below the nesting-houses that are occupied fasten around the tree or post a sheet of tin or zinc about eighteen inches wide, to protect the houses from cats.

Put out yarn, string, cotton batting, and other nesting-material.

June.

Put out fountains for drinking and bathing.

Keep cats shut up.

July–September.

Keep fountain clean and filled with fresh water.

October–February.

Begin early to put out food, suet, grains, etc.

After storms, trample down the snow and throw out grains.

Examine feeding-shelves and hoppers after storms and keep them constantly supplied with food.

Keep suet-baskets full.

Put out nesting-boxes for shelter.

CHAPTER XXII

DOMESTICATION OF WILD BIRDS

Success achieved. Considerable progress has been made in recent years in the domestication of wild birds. Many experiments have been tried with a great variety of birds with varying degrees of success, but some have been so fully successful that several species of wild birds may be considered partially domesticated.

These experiments have been tried with two classes of birds, the water-fowl and the so-called gallinaceous birds, or land game-birds. Among the first group the birds which have been successfully reared in captivity are ducks, geese, and swans. Among the gallinaceous birds, the bob-whites and several other quail, the ruffed grouse, the prairie hen, the wild turkey, and pheasants have been successfully reared.

The greatest success has been achieved in rearing the mallard duck. Some strains have become thoroughly domesticated like barnyard fowl. Other ducks which have been successfully reared are the wood duck, pintail, redhead, gadwall, widgeon, shoveler, green-winged and blue-winged teals, black duck, canvasback, and lesser scaup. The Canada goose has also been successfully reared.

The rearing of wild birds has now become quite an industry. In a recent issue of a paper devoted to outdoor life were advertisements of four firms offering for sale wild birds which had been reared in captivity. Many people are raising bob-whites, pheasants, and ducks.

Nine States have game farms on which various species of wild birds are reared.

The artificial rearing of birds settles the question of the preservation of any species of bird, for as soon as a bird is reared artificially the danger of its extermination is past. The wood duck was formerly classed as a "vanishing game-bird," but now it is being raised artificially by the thousands and in some localities is becoming common.

A book treating of the domestication of wild birds has recently appeared, entitled "The Propagation of Wild Birds," by Herbert K. Job. So far as the author knows, this is the first manual of its kind to be published in this country. Those who are interested in the exact methods by which the various species of birds are reared will find full directions in this book. Mr. Job has also prepared two bulletins on the subject, one on "Propagation of Upland Game Birds," and another on "Propagation of Wild Water Fowl." These are sold for twenty-five cents each by the National Association of Audubon Societies.

Methods of rearing wild birds. In some ways the general methods used in rearing all wild birds are

similar. Two general methods are in use, the artificial method and the natural method. In the artificial method the birds are kept confined and the young reared in much the same way as poultry. In the natural method the birds are allowed to breed in their natural way, but are protected and helped in every way possible. Each of these methods has its advantages and they may be combined.

Rearing the bob-white. Among the gallinaceous birds the greatest success has been achieved with the bob-white. The Massachusetts Commission on Fisheries and Game raised several hundred in 1914. Mr. A. C. MacVicar, of New Jersey, has raised one hundred and fifty in a season, the Connecticut State Farm at Madison about two hundred, Mr. Harry T. Rogers, of New York, four hundred, and the New Jersey Commission about five hundred. There are a number of men who raise large numbers with as much certainty as one raises poultry.

The following résumé is given in Mr. Job's "Propagation of Wild Birds": —

Résumé of plan. Following is a résumé of the general plan, based upon my own experience and observation, which I suggest for the handling of quail on an estate, farm, or preserve: —

1. Secure breeding-stock in late fall or early winter either by purchase or by capture of a small stock by permission of the authorities.

2. Keep through the winter in a wire enclosure with simple shelter from storms and cold winds.

3. In April, separate the pairs, having each pair in a small pen by itself. Some can remain in the larger pen together, if there are not enough small pens.

4. Hatch out the eggs and raise the young with bantams. Do not attempt incubators and brooders.

5. Put the breeders back into the large pen together by the latter part of July, unless they wish to incubate.

6. In late fall or early winter, catch up what young are desired. The rest can be left wild to breed naturally, next summer. Feed regularly under shelters throughout the winter, to hold them on the land, as also by planted areas of grain left standing for them. In severe winter weather coveys might be shut up and cared for, and let go again.

Pheasants. Pheasants are very widely reared in large numbers. The game farm of West Virginia has distributed two hundred pheasants, the Iowa farm seven hundred, the California farm four thousand, the New Jersey farm forty-four hundred, the Connecticut farm six thousand, and the New York farm ten thousand. Mr. Donald MacVicar hatches annually about four thousand.

Ruffed grouse. Dr. Clifton Hodge was the first man successfully to rear ruffed grouse. Mr. Herbert K. Job has conducted a number of successful experiments with them. Mr. Rogers raised seventy-five young grouse in one season. The American Game Protective and Propagation Association has raised them for three successive generations on its game farm at South Carver, Massachusetts.

Wild turkeys. Wild turkeys have been success-

fully reared on the preserve of the Woodmount Rod and Gun Club in Maryland. One season two hundred young turkeys were reared.

Canada goose. The Canada goose is easily reared in captivity, and is readily tamed, even more readily than ducks. Mr. J. W. Wheaton, on Chincoteague Island, Virginia, has raised Canada geese for more than fifty years. In 1909 he had about four hundred and fifty birds. About seventy-five pairs breed and he raises annually from two hundred to three hundred young birds. Some of these pairs are over fifty years of age and have come back spring after spring to nest for nearly half a century.

Ducks. Wild ducks are now being raised in large numbers. On the Walcott game preserve at Norfolk, Connecticut, from fifteen hundred to two thousand mallards are raised each season for the market. The Game Breeders' Association, of Sparrowbush, New York, during the season of 1913 gathered four thousand eggs from one hundred and seventy mallard ducks and hatched twenty-five hundred ducklings. The Clove Valley Rod and Gun Club, of Dutchess County, New York, during 1913 reared and marketed about four thousand mallards. During the season of 1914 Mr. Wallace Evans raised more than six thousand young wood ducks.

Wild ducks are easily reared. The outfit is simple and inexpensive, consisting of a pond or brook, an open shed, and a wire fence. The food is easily pro-

vided, and as the birds are hardy, they are easily kept in good health. It is easy also to rear the young. And it is even possible to rear them in a city back yard, if one has a cement basin and shrubbery. Mr. F. Manross has a pair of wood ducks which rear their young each year in a small artificial pond under the windows of his factory in Forestville, Connecticut. The water is kept open during the winter by a steam pipe and the birds remain here during the whole year. In another part of his yard he is rearing Canada geese, which were originally wild.

As another example of what may be done in a city back yard may be mentioned the case of Dr. A. F. Warren, of Chicopee Falls, Massachusetts. For several years he has kept several green-winged teals in his small yard, where he has made a cement basin and set out shrubbery.

Attracting wild ducks. In localities where ducks are found, much can be done to attract them without artificial breeding. Brooks may be dammed so as to make ponds and marshes. A few captive ducks kept on ponds may serve to attract wild ducks, which may remain and breed. Mallard ducks reared in captivity make good decoys and have been used successfully in attracting wild ducks into ponds, even when situated in city parks.

Food is another means of enticing ducks to remain. Such grains as corn, wheat, or rice may be scattered in shallow water, and ponds may be rendered still

more attractive to ducks by planting water-plants that are used by them as food. The most important of these are wild celery, wild rice, and pondweeds. A study of the stomach-contents of a number of individuals of sixteen species of ducks showed that these three plants composed one quarter of the food of these birds, divided as follows: pondweeds, fourteen per cent; wild celery, six per cent; and wild rice, five per cent. Every part of the plant of wild rice is eaten — stem, leaves, flowers, and seeds. The seeds may be obtained of several reliable dealers, and should be sown broadcast in the shallow water around the edge of the pond. Wild celery may be propagated in a similar way by seeds, and also by winter buds, and by pieces of the plant with a bit of rootstock attached.

Nineteen plants that serve as food for wild ducks are given in a bulletin published by the United States Bureau of Biological Survey. Among them, besides the three mentioned above, are: wapato, wild millet, musk grasses, duckweed, frogbit, water elm, marine eel-grass, water cress, and coontail.

Heronry. Mr. McIlhenny, of Louisiana, has been successful in starting a heronry near his home. He first secured some young herons from nests and reared them by hand. These went away during the winter, but returned in the spring and nested near his house. Other herons joined them, and there is now a large colony, containing thousands of herons

of various kinds. Mr. Herbert K. Job, who recently visited this heronry, writes: —

Several days were spent at Avery Island, Louisiana, where I was most kindly entertained by Mr. E. A. McIlhenny, whose astounding colony, artificially built up, of forty thousand snowy egrets, herons, and other water birds, attracted to his overflowed garden, might well be considered "the eighth wonder of the world."

CHAPTER XXIII

TEACHING BIRD-PROTECTION IN THE SCHOOLS

Purposes of bird-study. In the schools it is important that the teacher should have clearly in mind the purposes of bird-study so that these may serve as a guide in her teaching. The chief purposes of bird-study in the schools may be briefly stated as follows: first, to give the children greater pleasure in living through an acquaintance with the birds; second, to teach them the economic value of birds; third, to teach them to protect and to aid the birds.

Materials for bird-study. One of the features of nature-study that gives it special value is the fact that it deals with things at first hand, and the child is learning from a direct study of the thing itself instead of by reading about it. Hence it is important that there should be provided materials for the child to study. The best and final thing is for the child to study the living bird outdoors. For the schoolroom lessons some material is needed to create an interest which shall lead the child to this outdoor study. In most schools mounted birds cannot be obtained, and it is questionable whether these would be desirable, especially for young children.

As an introduction to bird-study sometimes it may be possible to keep a pet canary in the schoolroom for a few days.

Pictures. There is a substitute for mounted birds that can be used, which serves the purpose exceptionally well, namely, colored pictures. Very good pictures can now be obtained from the following sources: —

National Association of Audubon Societies, 1974 Broadway, New York City. About ninety pictures have been published, to which six are being added each year. The price is two cents apiece, including, besides the picture, an outline drawing and a four-page pamphlet descriptive of the bird's habits.

G. P. Browne Company, Beverly, Massachusetts. About three hundred and fifty pictures have been published. The price is two cents each. These may be obtained on light-weight mounts for four cents each.

Liberty Bell Bird Club, "Farm Journal," Philadelphia. Twenty pictures have been published and are sold at two cents each.

Massachusetts Audubon Society, 66 Newbury Street, Boston. This Society sells pictures mounted as charts. There are three charts known as the Audubon Bird Charts, twenty-seven by forty-two inches, arranged so that they can be hung in the schoolroom. Charts numbers 1 and 2 each contain twenty-six common birds, and Chart number 3,

twenty winter birds. The price of each chart is $1.50.

Handwork. For young children it is important that a large amount of handwork should be provided, as children acquire knowledge faster by this means. Colored pictures furnish material for this kind of work. The children are given uncolored outlines and, with the colored pictures before them, color in the outline, using either colored crayons or water-colors. The outlines may be obtained in three ways: First, they may be bought. The National Association of Audubon Societies sells an outline with each picture, but does not sell the outlines separately. Separate outlines of thirty common birds may be bought for one cent each of the Comstock Publishing Company, Ithaca, New York. Second, the teacher, by means of a mimeograph or other device, may make enough outlines to supply the class. Third, the children may make the outlines themselves. The older children may make free-hand drawings of the outline from the picture.

The younger children may trace the outlines. For this purpose two grades of paper are needed, the ordinary drawing-paper on which the final outline is to be colored, and some paper thin enough for tracing: thin typewriting paper will do. The thin paper is held over the picture and the outline of the bird traced. When this is finished, it is turned over and placed on the ordinary drawing-paper with

the outline next to it. The child takes his pencil and marks back and forth a number of times across the paper just over the outline already drawn. This causes enough of the pencil mark to be rubbed off to reproduce the outline on the second paper. The child may go over this outline with a pencil to make it clear, and then color it.

Free-hand outlines of birds may be cut from paper or cardboard and then colored on both sides with crayons. These may be suspended by means of thread to represent flying birds. Outlines may also be cut from thin pieces of board with a knife or fret saw, and then the two sides painted. These may be fastened to sticks to make flower-sticks to put in flower-pots.

The purpose of this work is to enable the children to identify the birds in the field more easily, because they have noted the colors and their location, and they should be encouraged to look for these birds. If this handwork stops in the schoolroom without leading to the study of birds outdoors, it may be questioned whether it is worth while.

Bird games. The game element may profitably be introduced into bird-study, especially with young children. Following are some games which the author has seen used that help the child in describing and identifying the birds: —

Games with colored pictures. *Game number 1.* The teacher shows the pictures one at a time to the

children, keeping the name covered. The child who first correctly names the bird takes the picture. The child who has the most pictures at the end of the game wins.

Game number 2. This may be used with older children. A large number of pictures are hung around the room and numbered, the names being covered. Each child writes the list of numbers on a piece of paper and opposite the number the name of the bird. The child who names the most wins.

Game number 3. The teacher pins the picture of some bird on a child's back and shows the picture to the class. The child stands before the class and asks questions of any one he wishes about the bird, till he guesses it correctly. He then names some one else to take his place.

Games without pictures. *Game number 4.* A child stands before the class and describes some bird which he has in mind. The children try to guess the bird from the description. The child who first guesses it correctly then begins the description of another bird.

Game number 5. This is a slight modification of the previous game. A child stands before the class and has some particular bird in mind. The children take turns in asking questions about the bird, its color, size, etc., till some one guesses the bird. This child then takes his turn in answering questions about some other bird.

Dramatization. Children enjoy dramatization and learn much thereby. Some simple bird play could be easily arranged and the parts taken by the children. The Liberty Bell Bird Club has arranged three plays: "The Workers," "The Birds' Return," and "The Birds' House-Hunting," which may be obtained of the "Farm Journal," Philadelphia, for three two-cent stamps each. Probably Percy MacKaye's "Sanctuary" could be adapted for grammar grades.

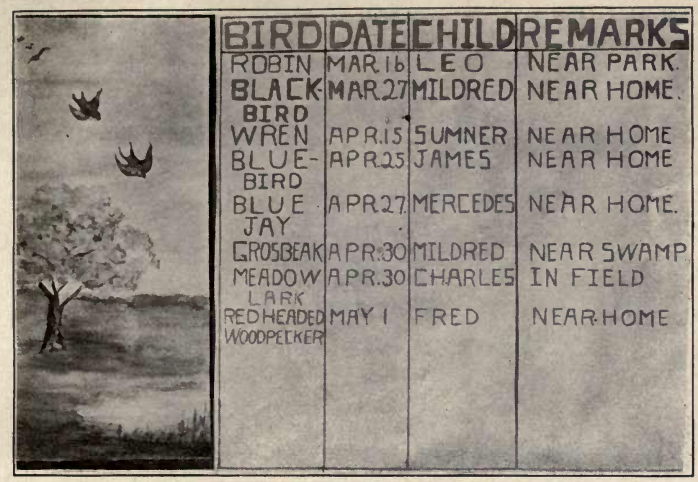
Bird calendar. A spring bird calendar is a source of never-failing interest, beginning even with the very youngest children and extending up through the grades. A calendar may best be kept on a large piece of heavy paper or cardboard. At the top should be some artistic decoration appropriate to the subject. For the young children the reports may be arranged in four columns: —

Name of bird	*Name of child first reporting*	*Date first seen*	*Where seen*

For the older children the following columns may be added: —

Date when abundant	*Date when nesting*	*Remarks*

The competitive element suggested in having the child's name appear on the calendar stimulates the children and arouses much interest. Several pre-



BIRD	DATE	CHILD	REMARKS
ROBIN	MAR. 16	LEO	NEAR PARK.
BLACK BIRD	MAR. 27	MILDRED	NEAR HOME.
WREN	APR. 15	SUMNER	NEAR HOME
BLUE-BIRD	APR. 25	JAMES	NEAR HOME
BLUE JAY	APR. 27	MERCEDES	NEAR HOME.
GROSBEAK	APR. 30	MILDRED	NEAR SWAMP
MEADOW LARK	APR. 30	CHARLES	IN FIELD
RED HEADED WOODPECKER	MAY 1	FRED	NEAR HOME

SCHOOL BIRD CALENDAR

Kept by a third grade

FEEDING-STATION FOR BIRDS IN YARD OF TRAINING-SCHOOL
MANKATO STATE NORMAL SCHOOL, MINNESOTA

cautions will need to be observed by the teacher. Children will often report very positively the appearance of a bird a month before it is due to arrive. If the teacher has access to a local calendar kept by some bird-student, it will help her in knowing when to expect certain birds. The migration dates for several localities in the eastern United States are given in Chapman's "Handbook of Birds." If the children report birds several weeks ahead of the dates given on some reliable migration record, probably they have made a mistake and they should be told so by the teacher.

After it is probable that the bird has arrived, it must be understood by the class that no bird's name is to go down on the calendar till the child has given such a good description of the bird that there is no doubt about its being seen. In case of doubt the name should not be put down.

One important line of work is to take up in turn in the various grades different species of birds so as to acquaint the child each year with a few new birds. For the younger children the most common and conspicuous birds should be studied, with emphasis placed on identification. In later grades other birds may be taken up and adaptations and economic value studied in addition to identification. The colored plates may be used to show the colors and their location as an aid to naming the birds when seen outdoors.

The children should be encouraged to look for the birds, and some questions may be written on the board that they may answer from a study of the bird. The children should be asked to report to the class the results of their observations, and frequent opportunities should be given for these reports. At first not all the children will make these studies and reports, but if the teacher encourages and expects this and gives opportunities for reports, the number of children who do this can be gradually increased.

As a means for reviewing and summarizing the birds from the standpoint of identification, the tables given later on pages 312 and 313 may be used.

The child's activities. One of the most effective phases of nature-study is that which calls into play the manual activities of the child in providing opportunities himself for making a study of the life around him. This principle of utilizing the child's activities is one that is well understood and applied in the kindergarten, but too little employed in later years. It will prove a most effective instrument to be used with the children when circumstances allow. Bird-study is specially well adapted to making use of these activities in building nesting-houses, in feeding the winter birds, and in providing fountains. The very fact that the child is doing something for the birds is a means of developing that helpful sympathy with nature which may prove such an important factor in all his subsequent life. And,

furthermore, an excellent opportunity is offered for watching the birds that may come in response to the attractions offered. These observations will be carried on with much greater ardor and thoroughness because the child has himself helped to furnish the conditions which make his observations possible.

Nesting-houses. Perhaps there is no one line of work that interests the children so much as the making of bird-houses, especially in the primary and intermediate grades. Even very young children are interested, and when they are too small to make the houses themselves, some one of the family at home may help them. The houses can be built at home or in the manual-training department. Children may be asked to bring materials, and then some one may help them in the manual-training shops. Many children may be interested to the point where they will make houses at home. As an added incentive the children may be asked to bring their houses to school on a certain day, so that a picture of the children with their houses may be taken.

The matter may be brought to the attention of the children in the early spring. The subject may be introduced by a general discussion of the nesting-habits of those birds that nest in hollow trees or other cavities. The children should be asked to search the neighborhood to ascertain to what extent these natural nesting-sites may be found. In many localities these have been entirely cleared away in the

development of the land for real-estate purposes, and hence there may be emphasized the necessity of building nesting-houses if we would keep these birds around our homes. The problems which arise in connection with the construction and location of bird-houses should be talked over with the children and the important precautions to be observed explained to them. The really essential features having been made clear, the children should be allowed to use their ingenuity and individuality about arranging details.

Difficulties. The children should understand the difficulties to be met, so as to avoid undue disappointment, and should be prepared to overcome them as far as possible. The greatest obstacle of all is the English sparrow. Some devices which may assist in keeping this bird away have been discussed in Chapter XIX, the most effective one of which is to make the hole so small that the sparrows cannot enter, but large enough for the wren and chickadee. With houses for bluebirds and tree swallows, probably the most effective thing which the children can do is to make the houses so that the tops can be easily lifted, and then to remove the sparrows' eggs once a week or as fast as they are laid. This often causes the sparrows to leave the nesting-house. If nothing else can be done the entrance can be covered or the house taken down, as soon as it is evident that no other bird is going to use the house,

thus preventing the sparrows from rearing their young. Of course killing the sparrow cannot be recommended to the children. Whatever is done along this line must be left to adults.

If the school-building is favorably situated, houses may be put up in the school-yard. If these are occupied, opportunity will be given the school for bird-study at close range. The children may be sufficiently interested to raise money for a martin-house to be erected in the school-yard, as was done by the children in the Training-School of the Mankato State Normal School, Minnesota.

It would be well worth while to see if the park boards would not coöperate with the schools, so that the children might make bird-houses and place them in the parks. Such a plan was carried out in Jackson and Washington Parks, Chicago, the children making several hundred wren- and bluebird-houses. During one season the children of Portland, Oregon, built eight thousand bird-houses and placed them in the various parks and about different sections of the city. Most of them were built by the pupils of the manual-training departments of the different schools. In many localities prizes have been offered for the best bird-houses. As a result thousands of bird-houses have been built by children. These houses are often kept on exhibition for awhile, and many of them are then sold by the children to the people of the community.

Feeding the winter birds. The introductory work to feeding the winter birds should be done in the late fall. A talk on the food of birds may be given, so as to bring out the two classes of foods, animal and vegetable. The kinds of food to put out and the methods of putting it out may be discussed. The necessity of providing a constant supply of food should be emphasized, and also of seeing that there is a good supply immediately after a snowstorm. The children may occasionally be reminded of the feeding so that they will not neglect it too long. The possibility of taming the birds to feed from the hand should be brought to the children's attention. The construction of winter-feeding devices, as suggested in Chapter XX, may be made a part of the manual-training work.

And while the children are being encouraged to feed the birds at home, a lunch-counter may be provided in the school-yard if the conditions will allow it. Committees may be appointed among the children to see that the counter is provided with food.

While the two methods of attracting birds already mentioned are the ones best adapted for school use, something may also be done in the line of encouraging the children to provide fountains. The planting of shrubs requires so long before the returns come in that this method of attracting birds will not appeal to children, but they may be en-

couraged to plant seeds of annuals, such as hemp, millet, and sunflower. In Carrick, Pennsylvania, a public-spirited man has been giving small mulberry and cherry trees to those children who would agree to plant them and take care of them. Previous to 1912, fifteen hundred trees had been given to the children.

Bird fountain in a school-yard. In some cases it may be practicable to construct a bird fountain in the school-yard. Such a fountain was built in a yard in Worcester, Massachusetts. Connections were made so that running water dripped into the basin and a drain carried off the surplus water. Wild flowers were planted in the crevices of the fountain and at its base, and clumps of shrubbery were planted near so that their fruit might furnish food for the birds. The first year the fountain was visited by twenty-five species of birds. Another similar fountain was built at Passaic, New Jersey.

Field trips. There is but one way to know the birds; that is, to study them in the field. In the schoolroom the children may be prepared for field studies and may learn about the value of the birds and how to protect them, but without a knowledge of the birds themselves enthusiasm will be lacking.

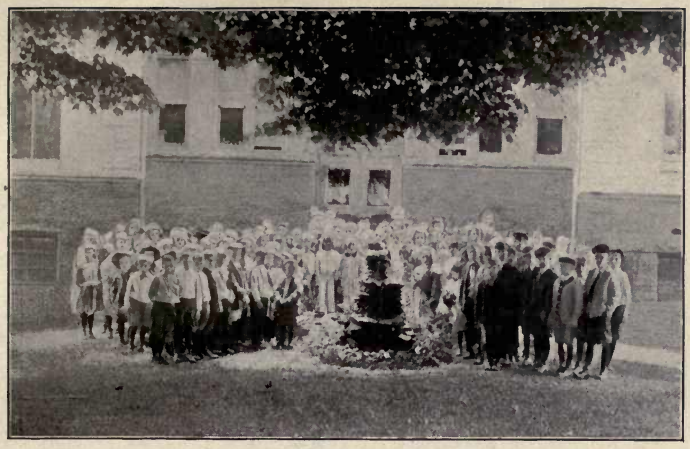
The ordinary class of thirty to forty children is too large to attempt a field trip as a body, but frequently some arrangement may be made with the principal by which half of the class may be taken

at one time. Sometimes walks may be taken with a few children who are especially interested.

Both teacher and children should start out with a very definite purpose in mind. The teacher should prepare and plan for the trip very carefully. One purpose may be to see how many kinds of birds can be identified and to make a list of them. Another purpose may be to make a special study of one or two kinds of birds, noting the size, general colors, song, nesting-habits, and methods of locomotion.

Whether field trips with the children are taken or not, the teacher should constantly encourage the children, when by themselves as they pass to and from school and when at home, to study the birds and report their observations to the class. One of the chief purposes of the field trips taken by the teacher with the children is to stimulate them to observe birds when by themselves.

Bird clubs. Much enthusiasm can be aroused by the organization of bird clubs. A local bird club can be formed anywhere, but more interest will be aroused if this is formed in connection with some large organization. There are at least two ways in which this may be done. One is through the National Association of Audubon Societies, as explained in Chapter XVI. Each child who wishes to join pays ten cents. The names are sent by the teacher to New York City to the Association, and each child receives in return ten colored bird pictures and an



SCHOOL BIRD FOUNTAIN, PASSAIC, N.J.

JUNIOR AUDUBON CLASS AT TRAINING-SCHOOL
MANKATO, MINN.

Audubon button, which has on it a picture of the robin and the words "Audubon Society"; and if there are ten or more members, the teacher receives "Bird-Lore" for one year.

Another means is through the Liberty Bell Bird Club of the "Farm Journal," Philadelphia, to which reference has been made in Chapter XX. The pledge there printed is written at the top of a sheet of paper and the children who wish to join write their names under this pledge. This list is sent to the "Farm Journal" at Philadelphia, and each child in return receives a little pamphlet, entitled "Guide of the Liberty Bell Bird Club"; and also a bird button, which has on it a picture of a swallow and of the Liberty Bell, and printed across it the motto "Protect Our Feathered Friends" and around the circumference the name "The Liberty Bell Bird Club."

The advantage of the first club is that each child receives pictures which may be used in connection with the meetings of the club. The advantage of the second club is that no money is required. The teacher can select whichever seems best suited to the locality where she is teaching. Except with the very young children, it is well to elect officers and to allow the children to assume the chief responsibility for the work of the club under the supervision of the teacher.

There is a great variety of things that may be done at the meetings of the club. If the colored

plates are used, the children may color some of the outlines. Any one of these birds may be taken as the topic of the meeting, and the pamphlet and other references studied in preparation, different children being assigned topics to look up. About a week before the meeting, the bird to be studied should be announced, so that the children may be watching the birds outdoors and report what they have seen. A meeting may be held to discuss the making of bird-houses, and at another meeting these may be brought together and compared. A number of field trips should be taken to study the birds outdoors. All of the above can best be done in the spring. In the fall nests may be collected and studied. In the winter the subject of winter feeding may be taken up.

From a number of letters published in "Bird-Lore" explaining about the work of the clubs, the following list is taken of the things which were done by the various clubs: —

Prizes offered for the following: —
- Best bird-houses.
- Greatest number of bird-houses for different birds.
- Longest list of birds identified from pictures.
- Best bird records.
- Best composition showing intimate knowledge of birds.
- Best colored drawing of some bird.
- Prize to the school or room having the largest number of clippings in their bird-clipping book.

Making bird-houses, feeding devices, and fountains for the home yard.

Building bird-houses to put up in school-yard.
Exhibition of bird-houses open to the public.
Members of clubs give talks to children in other buildings.
Talks given to club by various members about some birds shown by the radiopticon.
Demonstration of tying suet to branches of trees.
Debates on such questions as, "Should the crow be protected?"
Providing Christmas tree for the birds.
Field trips.
Publication of a paper containing articles about birds.
Playing bird games.
Spring migration records of birds kept by club.
Attending illustrated lecture given by some one who has lantern slides.

The following are the suggestions for meetings as given in the "Guide of the Liberty Bell Bird Club":

First: Repeat in concert the pledge of the Liberty Bell Bird Club.

Second: Members report all the different varieties of birds seen since the last meeting. This report to be written, read, and given to the teacher or director and to be filed.

Third: Recitation or reading — a bird poem or a bird story. Many good ones appear from time to time in the "Farm Journal's" Bird Club column and elsewhere in the paper.

Fourth: Members report what they have observed and all special bird work done by them.

Fifth: Composition on one of the articles in the Bird Club page of the "Farm Journal." Subject to be given by the teacher or director.

Sixth: Question box.

Seventh: Work outlined by teacher or director for the following week.

Eighth: Adjournment.

In many cases enough interest is aroused so that the members of the club meet during the summer vacation at the homes of the members.

Bird Day. Bird Day is observed often in connection with Arbor Day. Bird Day is now officially recognized in nine States. In observing this day one special feature to be emphasized is doing something for the birds, such as putting up houses at home or in the school-yard. The program should not be so formal as to obliterate this important feature. The following are suggestions for a few general lines of work that may be carried on: —

1. Reading of proclamation.
2. Talk by some one outside of the schools.
3. Talk by teacher.
4. Original essays by children.
5. Reports on outdoor observations.
6. Recitations and readings.
7. Dramatic presentation.
8. Songs.
9. Putting up bird-houses and planting shrubs in school-yard to attract birds.

Arbor and Bird Day Annuals are published in some States, which give many helpful suggestions.

Correlation with other subjects. Bird-study may do much to add to other lines of school work and may also itself be made more interesting by proper

correlation. Many opportunities present themselves in connection with several subjects, especially with art and literature.

The following chart suggests briefly something of what may be done along this line: —

Literature	*Art*	*Manual training*	*Language*	*Geography*	*Civics*	*Arithmetic*
Read literature about the birds studied.	Color outlines of birds. Make artistic bird calendar.	Make nesting-houses, feederies, and fountains.	Reports on outdoor observations.	Migration. Seasonal change in bird life.	Bird club to protect birds.	Problems on the number of insects eaten by young birds.

Birds and literature. A study of good literature should form an important part of the work with birds. Below is a list of books containing bird poems: —

For Primary Grades

Ingpen, *One Thousand Poems for Children.* G. W. Jacobs & Co., Philadelphia. $1.25.

McMurry and Cook, *Songs of Tree-Top and Meadow.* Public School Publishing Co., Bloomington, Ill. $.40.

Wiggin and Smith, *The Posy Ring.* Doubleday, Page & Co., Garden City, N.Y. $1.25.

For Intermediate Grades

Bailey and Lewis, *For the Children's Hour.* Milton Bradley Co., Springfield, Mass. $1.50.

Knowlton, *Nature Songs for Children.* Milton Bradley Co., Springfield, Mass. $1.00.

Lovejoy, *Nature in Verse.* Silver, Burdett & Co., Boston. $.60.

For Grammar Grades

Burroughs, *Songs of Nature.* Doubleday, Page & Co., Garden City, N.Y. $1.35.

Lovejoy, *Poetry of the Seasons.* Silver, Burdett & Co., Boston. $.60.

Williams, *Through the Year with Birds and Poets.* Lothrop, Lee & Shepard Co., Boston. $1.00.

Below are suggested a few books for the children's library, which are written in a style that children can understand: —

Burroughs, *Bird Stories from Burroughs.* Houghton Mifflin Co., Boston. $.60.

Gould, *Mother Nature's Children.* Ginn & Co., Boston. $.60.

Johonnot, *Neighbors with Wings and Fins.* American Book Co., New York. $.40.

Miller, *First Book of Birds.* Houghton Mifflin Co., Boston. $.60.

Miller, *Second Book of Birds.* Houghton Mifflin Co., Boston. $1.00.

Stickney and Hoffmann, *Bird World.* Ginn & Co., Boston. $.60.

Walker, *Our Birds and their Nestlings.* American Book Co., New York. $.60.

Wright, *Gray Lady and the Birds.* Macmillan Co., New York. $1.00 (school edition).

Arithmetic and bird-study. Some problems in arithmetic relating to the number of insects eaten by birds, the numbers of birds, and other topics may be given the children. A few are here suggested: —

A. Problems on the number of insects eaten by nestlings.

1. A pair of wrens were observed to feed their young 17 times in an hour. The parents fed their young from 5 A.M. till 8 P.M., and the young remained in the nest 15 days. Assuming that one insect was brought at each visit, how many insects were destroyed by this brood of wrens?

2. During an outbreak of locusts in Nebraska in 1874, a man

saw a long-billed marsh wren carry 30 locusts to her young in an hour. At this rate how many locusts did the brood consume in a day of 12 hours? The area of Nebraska is about 77,000 square miles. If we assume that there were 20 broods of wrens to each square mile, how many locusts did the wrens in Nebraska destroy in one day?

3. Many birds on the average feed their young about 200 times a day, and the young stay in the nest about two weeks. After the leaves have fallen, count the number of nests in a certain area and then estimate the number of insects that have been destroyed by the birds reared in these nests, assuming one insect brought at each feeding.

4. A 40-acre farm in Rantoul, Kansas, had 157 pairs of birds nesting on it in 1914. Assuming that the birds averaged to feed their young 200 times a day, and that the young remained in the nest 14 days, how many insects per acre were destroyed by these birds? How many insects were destroyed on the whole farm?

B. Problems on amount of food eaten by adult birds.

1. A study made of owls during the winter months showed that they destroyed 2 mice a day. It has been estimated that each mouse does damage to the extent of 2 cents each year. How much is an owl worth a year?

2. A study made by the Biological Survey of the red-shouldered hawk showed that out of 214 birds, 3 had eaten poultry and 102 had eaten mice. What per cent of the birds had eaten poultry and what per cent mice?

C. Problems on the numbers of birds.

1. A census made of birds in the eastern United States showed that there was an average of 6 pairs of robins to each farm of 58 acres. There are about 4,000,000 farms east of the Mississippi, averaging 93 acres each. How many robins are there on the farms east of the Mississippi River?

2. This census also showed that for every 100 robins there were 83 English sparrows, 49 catbirds, 37 brown thrashers, 28 house wrens, 27 kingbirds, and 26 bluebirds. How many individuals of each kind of birds are there on the farms east of the Mississippi River?

3. This census also showed that there was an average of one pair of birds per acre. How many birds are there altogether on the farms east of the Mississippi River?

D. Problems on migration.

1. Some Arctic terns travel each year from the edge of the Antarctic continent to the most northern part of North America, a distance of 11,000 miles. It takes the bird about 20 weeks to make the round trip. How far does it travel in a day?

2. The robin as a species travels from Iowa to Alaska, a distance of 3000 miles, in 78 days. How many miles does the robin average to travel in a day?

E. Problems on the number of birds killed by cats.

1. A man in Massachusetts wrote to many people in the State asking about the number of birds killed by a single cat. The answers received from several hundred persons showed that on an average a cat kills 33 birds during 1 month at the height of the nesting-season, and that each farm averages to keep 2 cats. There are in the State 37,000 farms. How many birds do the cats on these farms kill each season?

2. Find the number of cats kept in your locality, and estimate the number of birds killed each year by these cats, assuming, as in the previous problem, that each cat kills 33 birds in a season.

F. Miscellaneous problem.

1. A study of hawks made by the United States Department of Agriculture showed that 5 kinds were harmful, 7 kinds were neutral, and 35 kinds were beneficial. What per cent of the hawks respectively are harmful, neutral, and beneficial?

Essentials of a good lesson. As previously mentioned, the teacher needs to consider the matter of materials in planning for a bird lesson; and it is also suggested that a consideration of the three following points for each lesson or topic taught may prove helpful: (1) the child's problem; (2) the development of the lesson based on the problem; and (3) the application or use by the child of what he has been taught.

Child's problem. The child's problem is a means of arousing the child's interest. It should be a ques-

tion that appeals to him, that he is anxious to solve. This should find its origin in the present needs and interests of the child; that is, it should be a child's and not an adult's problem. It should be very definite and specific and so stated as to involve only one leading thought. It should be something the solution of which is evidently worth while. This problem will serve, not only as a stimulus to the child, but also as a guide to both child and teacher to determine what particular phases of the topic shall be considered. Hence it is evident that the first step is to get the problem clearly before the children so that they may understand the purpose of the lesson. In order to interest the children in the problem, it should be led up to by questioning them about things they already know concerning some topic closely related to the problem. The problem should be the central thought of the lesson around which the points to be taught may be grouped.

In the outline given on the following pages, questions are suggested which may serve as problems for the topic under consideration.

Development. The development should be based on the problem. The purpose of this is to solve the problem, and only those points should be included which are necessary for this solution. All other points should be omitted. On the other hand, enough points should be included to answer the problem satisfactorily. The problem will be the

basis, not only for the selection of the subject matter, but for its organization as well.

Application. The use of knowledge is the chief end of education. One of the vital things in planning a nature-study lesson is to consider how the children may be encouraged to make use of what they have learned. If the problem does not seem to allow of any application, it may well be questioned whether it has been wisely chosen. The application should be the doing of something which interests the child and which can be done naturally in his ordinary life. It should be so clearly stated that the child has a very definite idea of what is to be done. It is usually well to suggest only a few things at a time, perhaps only one.

Following are suggested some ways in which application may be made in bird-study: (1) actually doing the things taught in the lesson, as in building nesting-houses, feeding winter birds, and providing fountains; (2) making outdoor observations on the birds studied in the schoolroom; (3) watching others do the things studied, such as planting of shrubs in the parks and the erection of martin-houses; (4) making a collection of birds' nests (in the fall) and of nesting-houses; (5) talking over with parents at home the topics studied; (6) cutting out clippings from newspapers and magazines relating to the topic under consideration, and bringing them to school.

As a definite illustration of these suggestions the following lesson is given for a third grade: —

1. Grade and season: third, spring.
2. Topic: nesting-house for wren.
3. Materials: picture of house wren, wren's nest, several types of wren's houses.
4. The lesson.
   A. The child's problem.
      1. Approach to child's problem.
         What kind of a house do you live in? Of what is it made? How many floors are there? How many rooms? How many windows and doors?
      2. Statement of child's problem.
         We will try to learn to-day what kind of a house we should make for a pair of wrens to nest in.
   B. Development.

Outline of points.	*Questions.*
1. Kinds of materials to use.	How many different kinds of materials can we use? Which do you think will be the best? Why?
2. Size of house.	How can we tell how large to make the house? How large a nest does the wren make? How large is the bird?
3. Shape of house.	What shape is your house? What shapes can we make the house for the wren? Which do you think is the best shape?
4. Entrance hole. A. Size. B. Shape. C. Location.	How large is the house wren? How large shall we make the entrance? What is the best shape to make it? In what part of the house shall we make it?
5. Provision for fastening.	What shall we put on the house so we can hang it up? Which of these houses do you think a wren would like best? Why?

C. Application.

How many would like to make a wren house so as to have a pair of wrens nest in your yard? How many of you will try and find materials to make it of, such as thin boards, a cigar-box, or a chalk-box? If you cannot make the house yourself, ask some one at home to help you, or you may bring the material to school and I will help you. See if you can all get your houses finished in a few days, and you may all bring your houses to school a week from to-day, and we will have a picture taken of those children who have their bird-houses with them.

This lesson should be followed by another, after the house is finished, on how to put out the house, involving a consideration of the place to put it, the height, the method of fastening, and protection from cats.

Two problems are constantly confronting the teacher: first, how to teach, and second, what to teach. Some suggestions on the first problem have already been given. A partial solution of the second problem is offered in the following outline of bird-study arranged by grades and seasons: —

OUTLINE OF BIRD-STUDY

(Arranged by grades and seasons with problems suggested for the various topics)

First Grade

Spring

1. Bird walks.
2. Special study of robin and bluebird.

Problems.

How can we tell the bluebird when we see it? (See page 310.)

Why do you like the robin?

Second Grade

Spring

1. Bird calendar.
2. Bird walks.
3. Special study of the red-winged blackbird, Baltimore oriole, and chimney swift.

   Problems.

   How can we tell the oriole (or blackbird or swift) when we see it outdoors?

   How does the swift differ from the oriole in its habits?

   Which do you think is the most interesting bird of these three?

Third Grade

Winter

Christmas dinner for the birds. (Use old Christmas tree.)

Problem.

What kind of Christmas gifts do birds like?

Spring

1. Bird calendar.
2. Bird walks.
3. Special study of house wren, scarlet tanager and rose-breasted grosbeak.
4. Building nesting-houses for the wren.
5. Bird club organized and meetings held through the term.

   Problems.

   Which do you think is the prettier bird, the tanager or the grosbeak?

   How can you tell each of these from other birds?

   Why would you like to have a wren nest around your home this summer?

   What kind of a house shall we make for a wren to nest in? (See page 303.)

   What can our bird club do to help the birds?

Fourth Grade

Fall

1. Departure of birds; comparison with bird life in the spring.
2. Bird club meets to report on experiences with bird-houses the previous summer.

Spring

1. Bird calendar.
2. Changes in bird activities as the season advances.
3. Special study of the birds of the dooryards and shade-trees, such as blue jay, English sparrow, robin, bluebird, chipping sparrow, house wren, Baltimore oriole, yellow warbler.
4. Building nesting-houses for the wrens.
5. Formation of bird clubs; meetings through term.
6. Fountains for drinking and bathing.

Problems.

What changes do you notice in bird activities as the season advances?

Is the English sparrow a nuisance or is it of value to us?

Of what use is the robin to us?

How is the oriole fitted for its life in the air and among the trees?

How can you tell the yellow warbler from the goldfinch?

How can we provide water for the birds during the summer? (See page 311.)

Why would you like to form a bird club?

Fifth Grade

Winter

Winter birds, such as the blue jay, nuthatch, chickadee, woodpecker; their identification and feeding.

Problems.

What is the best way of telling the winter birds apart?

How can we help them? (See page 311.)

Spring

1. Special study of birds of the air, such as the bank swallow, tree swallow, barn swallow, eave swallow, martin, chimney swift, nighthawk.
2. Building nesting-houses for the bluebird.
3. Study of nesting-habits of birds.
   Nest — location, materials, construction; eggs — number, size, color, incubation; young birds — care given by parents, time in nest.
   Putting out nesting-material.
4. Formation of bird clubs and meetings through term.
   Problems.
   In what ways are swallows fitted for living on the wing?
   How can we tell the different swallows apart?
   Of what use are the swallows to us?
   What makes bird-houses a better protection to birds than their natural nesting-sites?
   How can we get the bluebird to help destroy the insects in our garden?
   What materials do birds' nests contain that we can put out for the birds to use? (See page 312.)
   What care do parent birds give their young?

SIXTH GRADE

Fall

1. Migration.
2. Nest census (after leaves fall).
   Problems.
   Which are among the first birds to leave and which stay the longest?
   How many nests can we find in the trees and shrubs growing within two blocks of the schoolhouse?

Winter

1. Value of winter birds.
2. Helping the birds by feeding them.
   Problems.
   What do the winter birds do for us?
   How can we help the winter birds?

Spring

1. Special study of birds of the marsh, such as the red-winged blackbird and marsh wren; and of birds of meadows and fields, such as the bob-white, horned lark, meadowlark, vesper sparrow, field sparrow, cowbird, bobolink.
2. Building open nesting-boxes for the robin and the phœbe.
3. Migration — times, groups of birds (permanent, summer, and winter residents, and transient visitants); routes, distances, calendar of spring migration.
4. Bird-protection; special emphasis on the work of the Audubon societies. Formation of an Audubon Bird Club.
5. Grouping of birds according to color and size. (See pages 312 and 313.)

Problems.

Why is the red-winged blackbird an interesting bird to study?

Of what use are the birds of the meadows and fields to us?

Which is the most valuable of these birds?

What kind of a nesting-box can we make so as to get a pair of robins or phœbes to nest in it? (See page 313.)

How are birds grouped according to the time of the year they stay with us?

Let us try to follow on a map the travels of a bobolink for a year.

What is the Audubon Society doing to protect birds? (See page 314.)

What can we do in our Audubon Club to help the birds?

Seventh Grade

Spring

1. Birds of the garden and orchard, such as the chickadee, cuckoo, kingbird, nuthatch, phœbe, woodpecker, grosbeak, bluebird.
2. Attracting bird friends to the yard and garden by planting shrubs and providing fountains.
3. Bird songs; use for identification, differences, methods of recording, time given.
4. Plumage and moulting; differences in color due to age, sex, and season.

Problems.

Why is it desirable to have birds around the yard and garden?

Which is the most interesting bird?

How may each of these birds be identified?

In what ways is the wren (or other bird) useful?

What may be done to increase the number of birds around our homes?

How can we identify birds from their songs?

Through what changes in plumage does a rose-breasted grosbeak pass from the time it is first hatched till it is two years old.

Eighth Grade

Spring

1. Special study of birds of the woods, such as warblers, thrushes, woodpeckers, and vireos.
2. Economic value of birds to the forests in destroying injurious insects; value elsewhere in destroying weed seeds and rodent pests.
3. Bird-enemies; natural enemies, cat, man as an enemy.
4. Work of the National Government to protect birds.
5. Adaptations shown in bill, feet, wings, and tail.

Problems.

In what ways are birds useful to the forest?

In what other ways are birds useful?

Which is greater, the good or harm that birds do?

Are all of our birds worthy of protection?

How may we identify the different species of the following families; warblers, vireos, woodpeckers, thrushes?

What interesting habits of these birds may we study this spring?

Which have done more harm to the birds, man or the birds' natural enemies?

What is the National Government doing to protect birds? (See page 315.)

How can we help in the work of protecting birds?

How do the water-birds differ from the land-birds in the structure and use of their feet, bill, wings, and tail?

Series of lessons. Following is a series of lessons based on the outline already given. For each lesson, the child's problem, the outline of the points of the development, and the application are suggested: —

First Grade — Spring.
Topic, the Bluebird.
Materials, colored picture of a bluebird.
Child's problem.
How can we tell the bluebird when we see it?
Outline of development.
1. Color.
A. On back.
B. On breast.
2. Size.
Application.
Ask the children to watch for a bluebird and report to the class the first one they see.
Correlated work.
Have children color outline of bluebird.
Read from
Wiggin and Smith, *Posy Ring*, page 68.
Wright, *Gray Lady and the Birds*, page 318.
Walker, *Our Birds and their Nestlings*, page 24.

Second Grade — Spring.
Topic, the Baltimore Oriole.
Materials, colored picture and nest of the oriole.
Child's problem.
Why would you like to have a pair of orioles nest in your yard?
Outline of development.
1. Pretty colors.
2. Pleasing song.
3. Interesting nest.
4. Care of the young.
Application.
Ask the children to watch for the oriole, and when they find one, watch what it does and report to the class.

Correlated work.

Color outline; draw nest or make free-hand cutting.

Read from some of the following: —

Whittier, *Child-Life*, page 64.

Burroughs, *Songs of Nature*, page 74.

Bailey and Lewis, *For the Children's Hour*, page 171.

Wright, *Gray Lady and the Birds*, pages 413 and 419.

Third Grade — Spring.

Topic, Wren's House. (See page 303.)

Fourth Grade — Spring.

Topic, Bird Fountains.

Materials, pictures of fountains; receptacles suitable for fountains, such as pans and flower-pot saucers.

Child's problem.

How can we provide water for the birds to drink and bathe in during the summer?

Outline of development.

1. Kind of fountain.
2. Depth of water.
3. Character of edge and bottom.
4. Keeping fresh supply.
5. Places to put fountain.

Application.

Encourage the children to put out the fountains around their homes and report the results to the class.

Fifth Grade — Winter.

Topic, the Winter Birds.

Materials, samples of food that may be used, such as grains, nuts, etc.; a few simple feeding-devices, such as shelves, hoppers, and a suet-basket.

Child's problem.

How can we help the birds this winter?

Outline of development.

1. Kinds of food.
2. Methods of putting it out.
3. Birds that may come.
4. Taming birds to feed from the hand.

Application.

Having a feeding-station put in school-yard and food provided by children. Encourage children to feed the birds at their homes and to report the results.

Correlated work.

Have the children in the manual-training department make various feeding-devices, such as suet-baskets, shelves, hoppers, moving counters, and a large feedery for the school-yard.

Fifth Grade — Spring.

Topic, Nesting-Material for the Birds.

Materials, a collection of nests; samples of things that may be put out, pictures of some birds most apt to use these materials, such as the oriole, chipping sparrow.

Child's problem.

We will examine these nests to find what kind of material they contain that we may put out for the birds to use in making their nests.

Outline of development.

1. List of things found in nests.
2. List of things furnished by man.
3. Relative abundance of materials.
4. Birds making most use of these materials.

Application. Encourage the children to put out things around their homes that birds might use in their nests, such as string, yarn, cotton batting, pieces of cloth, horsehair, etc.

Sixth Grade — Spring.

Topic, Identification of Birds. (A review lesson.)

Child's problem.

What are the most common colors found on birds by which we may identify them?

Write on the board a list of all the birds the children know. Then put the following table on the board and have the children fill in the names of the birds in the proper columns: —

Birds marked with					
Red	*Blue*	*Yellow*	*Brown*	*Black*	*Gray*

Sixth Grade — Spring.

Topic, Size of Birds. (A review lesson.)

Child's problem.

How do our common birds compare in size with the English sparrow and the robin?

Write on the board a list of the birds that the children know. Then put the following table on the board and have the children fill in the names of the birds in the proper columns: —

Birds grouped according to size				
Larger than the robin	*Same size as the robin*	*Between the robin and the sparrow*	*Same size as the sparrow*	*Smaller than the sparrow*

Sixth Grade — Spring.

Topic, Open Boxes for Robin and Phœbe.

Materials, pictures and nests of the robin and the phœbe; samples or pictures of open houses.

Child's problem.

How may we get a pair of robins or phœbes to nest in our yard and help destroy the injurious insects in our gardens?

Outline of development.

1. Kind of material to make house of.
2. Size of house.
3. Shape of house.
4. Number of open sides.
5. Place to put out.

Application.

Encourage children to make them and put out in their yards. Have one made for the school-yard.

Correlated work.

These boxes may be made in connection with the manual-training department.

Sixth Grade — Spring.

Topic, Work of the Audubon Societies.

Materials, samples of the leaflets published by the Aubudon

Societies; a November-December issue of "Bird-Lore," which contains the annual report of the National Association of Audubon Societies.

Child's problem.

What are the Audubon Societies doing to protect birds?

Outline of development.

1. Legislation.
2. Wardens.
3. Lecturers.
4. Bird reservations.
5. Publications.
6. Junior Audubon Societies.

Application.

Have the children form a Junior Audubon Class to help protect the birds.

Seventh Grade — Spring.

Topic, the Robin.

Materials, picture of robin, nest; pictures or samples of insects eaten.

Child's problem.

Which is greater, the good or the harm that the robin does?

Outline of development.

1. Good done.
   - A. Injurious insects eaten.
   - B. Pleasure given as an interesting bird.
2. Harm done.
   - A. Fruit eaten.
3. Comparison of the two.

Application.

Ask the children to watch the robin and see if they can tell what it eats.

Eighth Grade — Spring.

Topic, Hawks and Owls.

Materials, pictures of hawks and owls and of the animals they eat.

Child's problem.

Should hawks and owls be protected?

Outline of development.

1. Beneficial species.
2. Neutral species.
3. Harmful species.

Application.

Have the children look up the state law to see which hawks and owls are protected. Have the papers watched and clippings made.

Eighth Grade.

Topic, Work of the National Government in Protecting Birds.

Materials, sample of bulletin published by the Bureau of Biological Survey; map showing location of bird reservations; copy of the Migratory Bird Law.

Child's problem.

What is the National Government doing to protect birds?

Outline of development.

1. Work of the Bureau of Biological Survey
2. Bird reservations.
3. Law protecting migratory birds.
4. Tariff restrictions on feathers.

Application.

Ask the children to watch the papers for items concerning any of the above, especially number 3, and bring clippings to class.

BIBLIOGRAPHY

THE following is a brief bibliography to suggest a few references for those who may wish to find more detailed discussion of the topics which have necessarily been briefly treated in these pages.

MIGRATION

CHAPMAN. *Handbook of Birds of Eastern North America.* D. Appleton & Co., New York.

COWARD. *Migration of Birds.* G. P. Putnam's Sons, New York.

National Geographic Magazine, April, 1911.

Bulletin 185 of the U.S. Bureau of Biological Survey.

MUSIC

CHAPMAN. *Handbook of Birds.*

Independent, vol. 63, pp. 491–97; 604–09.

Harper's Magazine, vol. 113, pp. 725–30; vol. 114, pp. 766–71.

MATHEWS. *Field Book of Wild Birds and Their Music.* G. P. Putnam's Sons, New York.

NESTS

DUGMORE. *Bird Homes.* Doubleday, Page & Co., Garden City, N.Y.

REARING THE YOUNG

CHAPMAN. *Handbook of Birds.*

HERRICK. *Home Life of Wild Birds.* G. P. Putnam's Sons, New York.

PLUMAGE

CHAPMAN. *Handbook of Birds.*

BEEBE. *The Bird.* Henry Holt & Co., New York.

HOW TO KNOW THE BIRDS

JOB. *How to Study Birds.* Outing Publishing Co., New York.

CHAPMAN. *Handbook of Birds.*

BAILEY. *Handbook of Birds of the Western United States.* Houghton Mifflin Co., Boston.

HOFFMANN. *A Guide to the Birds of New England and Eastern New York.* Houghton Mifflin Co., Boston.

REED. *Land Birds.* Doubleday, Page & Co., Garden City, N.Y.

ECONOMIC VALUE OF BIRDS

FORBUSH. *Our Useful Birds and their Protection.* Massachusetts State Board of Agriculture, Boston, Mass.

WEED *and* DEARBORN. *Birds in Relation to Man.* J. B. Lippincott Co., Philadelphia.

Publications of the U.S. Bureau of Biological Survey, sold at a nominal price by the Superintendent of Documents, Government Printing Office, Washington, D.C.

Bulletin No. 9. *Cuckoos and Shrikes.*

Bulletin No. 15. *Relation of Sparrows to Agriculture.*

Bulletin No. 17. *Birds of a Maryland Farm.*

Bulletin No. 21. *The Bob-White and other Quails of the United States in their Economic Relations.*

Bulletin No. 22. *Birds known to Eat the Boll Weevil.*

Bulletin No. 23. *The Horned Larks and their Relation to Agriculture.*

Bulletin No. 32. *Food Habits of the Grosbeaks.*

Bulletin No. 37. *Food of the Woodpeckers of the United States.*

Bulletin No. 39. *Woodpeckers in Relation to Trees and Wood Products.*

Bulletin No. 44. *Food of Our More Important Flycatchers.*

Bulletin No. 171. *Food of the Robins and Bluebirds of the United States.*

Farmers' Bulletins: —

No. 456. *Our Grosbeaks and their Value to Agriculture.*

No. 493. *The English Sparrow as a Pest.*

No. 497. *Some Common Game, Aquatic, and Rapacious Birds in Relation to Man.*

No. 506. *Food of Some Well-Known Birds of Forest, Farm and Garden.*
No. 513. *Fifty Common Birds of Farm and Orchard.*
No. 630. *Some Common Birds Useful to Farmers.*

Yearbooks of the Department of Agriculture. In nearly every Yearbook since 1894 are found articles dealing with the economic value of birds.

ENEMIES OF BIRDS

FORBUSH. *Useful Birds and their Protection.*

FORBUSH. *Game Birds, Wild Fowl, and Shore Birds.*

FORBUSH. *The Domestic Cat.* Economic Biology Bulletin No. 2. All three published by the Massachusetts State Board of Agriculture, Boston, Mass.

BAYNES. *Wild Bird Guests.* E. P. Dutton & Co., New York.

HORNADAY. *Our Vanishing Wild Life.* Charles Scribner's Sons, New York.

BIRD-PROTECTION

Bird-Lore. The issue for November-December in any recent year contains the annual report of the National Association of Audubon Societies.

FORBUSH. *Our Useful Birds and their Protection.*

HORNADAY. *Our Vanishing Wild Life.*

Reports of the Meriden (N.H.) Bird Club.

Reports of the Brush Hill Bird Club, Milton, Mass.

Circular No. 87 of the U.S. Bureau of Biological Survey. *National Reservations for the Protection of Wild Life.*

Farmers' Bulletin No. 692. *Game Laws for 1915.*

Circulars Nos. 92 and 93 of the U.S. Bureau of Biological Survey: — Circular No. 92. *Proposed Regulations for the Protection of Migratory Birds.*
Circular No. 93. *Explanation of the Proposed Regulations for the Protection of Migratory Birds.*

ATTRACTING BIRDS

BAYNES. *Wild Bird Guests.* E. P. Dutton, New York.

FORBUSH. *Our Useful Birds and their Protection.*

HIESEMANN. *How to Attract and Protect Wild Birds.* National Association of Audubon Societies, New York.

JOB. *Propagation of Wild Birds.* Doubleday, Page & Co., Garden City, N.Y.

TRAFTON. *Methods of Attracting Birds.* Houghton Mifflin Co., Boston.

Farmers' Bulletin No. 621. *How to Attract Birds in the Northeastern United States.*

Farmers' Bulletin No. 609. *Bird-Houses and How to Build Them.*

Bulletins Nos. 1, 2, and 3 of the National Association of Audubon Societies: —

1. *Attracting Birds around the Home.*
2. *Propagation of Upland Game Birds.*
3. *Propagation of Wild Water Fowl.*

National Geographic Magazine, March, 1914. Found also in *Some Common Birds of Town and Country,* published by the Magazine.

TEACHING BIRD-PROTECTION IN THE SCHOOLS

COMSTOCK. *Handbook of Nature-Study.* Comstock Publishing Co., Ithaca, N. Y.

HODGE. *Nature-Study and Life.* Ginn & Co., Boston.

TRAFTON. *Methods of Attracting Birds.* Houghton Mifflin Co., Boston.

INDEX

INDEX

Activities of children, 286.
American Ornithologists' Union, 175.
Application of lessons, 302.
Arithmetic and bird-study, 298.
Audubon classes, junior, 182–84, 292.
Audubon food-house, 255.
Audubon Magazine, 175.
Audubon Societies, National Association of, bird sanctuaries, 185; classes of membership, 177; department of applied ornithology, 184; egret-protection, 179; field agents, 184; formation of, 176; junior Audubon classes, 182–84; legislation, 178–79; lesson on, 313–14; needs of, 185; publications of, 180–81; summer courses in bird-study, 184; warden work, 179.
Audubon Societies, State, 186.
Audubon Society, first, 174–75.
Auk, great, 117.

Barrows, Prof. Walter B., 153.
Baynes, Ernest Harold, 9, 83, 98, 155, 209, 217, 231, 256, 263.
Beneficial birds, 110, 112.
Berlepsch, Baron von, 228.
Bird clubs; activities of, 216–17; for children, 292; number of, 217.
Bird day, 189, 296.
Bird-Lore, 58, 123, 140, 151, 180, 181.
Bird-study, attractions of, 48; equipment for, 50; how to study, 55; what to study, 56; when to study, 54; where to study, 53.
Blackbird, crow (grackle), dates of nesting and migration, 62; economic status of, 112; grain eaten by, 101; nest-robber, 108; number and kinds of insects eaten by, 74; table of food, 115; weed seeds eaten by, 87, 88.
Blackbird, red-winged, dates of migration and nesting, 62; economic status of, 112; feeding young, 36; food of, 115; grain eaten by, 101; nest of, 28; number of insects eaten by, 74; sexual differences in color, 46; song of, 16; weed seeds eaten by, 87.
Bluebird, attacked by English sparrow, 153; dates of migration and nesting, 62; destruction in winter, 133; economic status of, 112; food of, 115; killed by cats, 140; kinds of insects eaten by, 74; lesson on, 310; nesting-box for, 243; number of broods of, 32; number in United States, 126; plumage of nestlings, 45; sexual differences in color, 46; song of, 23; table of nesting-habits, 35.
Bobolink, change in plumage of, 45; dates of migration and nesting, 62; economic status of, 112; harm done in rice-fields by, 102–03; killed in South Carolina, 168; location of nest, 27; migration-route of, 8; song of, 23; winter home of, 6.
Bob-white, call of, 22; date of nesting, 61; destruction in winter, 132–33; economic status of, 113; food of, 115; in captivity, 65; insects eaten by, 74, 75, 83; killed in Louisiana and Alabama, 168; nest of, 27; number killed by cats, 140; rearing of, 273; weed seeds eaten by, 87, 88.
Bond, Frank, 158.
Bounties, 93.

Boys, shooting by, 165.
Bradley, Guy, 171.
Brooding young, 37.
Broods, number of, 32.
Brush Hill Bird Club, constitution of, 212–13; exhibit by, 211–12.
Bunting, indigo, dates of migration and nesting, 62.
Bureau of Biological Survey, 63, 73, 74, 75, 87, 88, 94, 95, 105, 114, 124, 192, 264, 265.
Burns, Frank L., 124.
Burroughs, John, 25, 28, 139, 214.
Burroughs Nature Club, 214–15.

Calendar, for attracting birds, 269; for children, 284.
Call-notes, 25.
Cardinal, food of, 115; kinds of insects eaten by, 74; song of female, 13; weed seeds eaten by, 87.
Carnegie foundation, 220.
Cat, dealers in traps for, 247; disease-carrier, 146–48; enemy of nestlings, 43; licensing, 148; method of doing harm, 135–36; number kept per family, 142; number of birds killed by, 139–46; protection of nesting-houses from, 39–40; protection of winter birds from, 258; remedies, 148–51.
Catbird, dates of migration and nesting, 62; economic status, 112; feeding young, 36; food of, 115; fruit eaten by, 99; nest of, 28, 29; number in United States, 126; number killed by cats, 140.
Cedar-bird, economic status of, 112; food of, 115; fruit eaten by, 99; growth of nestlings, 35; table of nesting-habits, 35, 36.
Census, by Bureau of Biological Survey, 57, 124; by *Bird-Lore*, 58, 123.
Chapman, Frank M., 43, 114, 137, 168, 180.
Chebec (least flycatcher); beneficial insects eaten by, 106; economic states of, 112; food of, 115; kinds of insects eaten by, 74; nest of, 28.
Chewink (towhee), dates of migration and nesting, 62; song of, 20.
Chickadee, date of nesting, 61; economic status, 113; nesting-box for, 243; number of insects eaten by, 73, 75; number killed by cats, 140; plumage of nestlings, 45.
Chicken, prairie, 21.
Child's problem, 300.
Coloration, protective, 46.
Colors of birds, lesson on, 312.
Cooke, Wells W., 5.
Correlation of bird-study, 296.
Counter-shading, 14.
Courtship, 26.
Cowbird, dates of migration and nesting, 62; economic status, 112; food of, 115; grain eaten by, 101; nesting-habits of, 31, 108; weed seeds eaten by, 87.
Crane, whooping, 120.
Creeper, brown, dates of migration, 61.
Crow, call-notes of, 25; date of nesting, 61; economic status of, 112; enemy of other birds, 129, 131; food of, 115; grain eaten by, 101; nest-robber, 108.
Cuckoo, economic status of, 113; food of, 115; number and kinds of insects eaten by, 73, 74.
Curlew, Eskimo, 120.

Dove, mourning, dates of migration and nesting, 62; economic status of, 112; food of, 115; weed seeds eaten by, 87, 88.
Dowitcher, 120.
Dramatization, 284.
Duck, Labrador, 117.
Ducks, attracting, 276; number killed in Louisiana, 168; rearing, 275.
Duets of birds, 19.

Dutcher, William, 169, 177, 256.
Dyke, A. C., 139.

Egg-collecting, 171–72.
Eggs, 33.
Egret, American, 120, 171.
Entrance hole of nesting-boxes, location of, 235; size of, 234–35.
Extinct birds, 116.

Fairbanks, Cornelia T., 150.
Feeding winter birds, by children, 290; dealers in apparatus for, 247–48; from hand, 251; in Audubon food-house, 255; in hopper, 255; in school-yard, 290; in suet-box, 254; in weather-cock food-house, 256; in window box, 256; kinds of food, 252; lesson on, 311; methods of, 253; need of, 250–51; on ground, 253; on moving counter, 256–58; on shelves, 253.
Field agents, 184.
Field, George W., 143.
Field-glasses, 51.
Field trips with children, 291.
Fisher, Dr. A. K., 94, 132, 138, 143.
Flagg, Wilson, 23.
Flicker, dates of migration and nesting, 62; food of, 115; method of feeding young, 37; nesting-box for, 243; number and kinds of insects eaten by, 74; number killed by cats, 140; song of, 16.
Fly, birds eating, 81, 83.
Flycatcher, crested, food of, 115; kinds of insects eaten by, 74; nest of, 29.
Flycatcher, least. See Chebec.
Food-house, Audubon, 255; weathercock, 256.
Food of birds, amount of, 72; how determined, 64–68; table of, 115.
Forbush, Edward H., 73, 88, 121, 122, 137, 138, 139, 140, 141, 143, 147, 156, 165, 224, 232, 237, 240, 244, 246, 249.
Ford, Henry, 218.
Foreigners, shooting by, 166.
Fountains, concrete, 261–62; dealers in, 247–48; essentials of, 260; in school-yard, 291; lesson on, 311; location of, 260.
Foxes, 129.
Fruit-eaters, 99.
Fruits, kinds eaten by birds, 265; succession of, 267; table of fruiting-periods, 260.

Game-birds, decrease of, 120.
Game laws, 189–91.
Game preserves, 218–20.
Games for children, 282.
Goldfinch, American, date of nesting, 61; plumage of nestling, 45; song of, 23.
Goose, Canada, 275.
Goshawk, 94.
Grackle. See Blackbird, crow.
Grain-eaters, 100.
Grinnell, George B., 174.
Grosbeak, rose-breasted, dates of migration and nesting, 62; economic status of, 113; feeding young, 36; food of, 115; number and kinds of insects eaten by, 74; sexual differences in color, 46; song of, 13, 23; weed seeds eaten by, 87; winter home of, 6.
Grouse, ruffed, location of nest of, 27; number killed by cats, 140; protective coloring, 47; rearing, 274.
Gull, Franklin's, number of insects eaten by, 74.
Gulls, 79.

Handwork for children, 281.
Hawk, broad-winged, 96.
Hawk, Cooper's, 96, 103, 107, 111.
Hawk, duck, 94.
Hawk, fish (osprey), 33.
Hawk, marsh, 96, 98, 103.
Hawk, pigeon, 95, 96, 107.
Hawk, red-shouldered, 96.
Hawk, red-tailed, 96, 103.
Hawk, Swainson's, 97.

Hawks, beneficial, 94; enemies of other birds, 129; food-chart of, 96; harmful, 94; money value of, 97.
Health, human, and birds, 81.
Henshaw, H. W., 90, 97, 114, 138, 162.
Herbaceous plants, 268.
Heron, snowy, 120.
Heronry, 277.
Hodge, Clifton H., 157, 274.
Hopper, automatic, 255.
Hornaday, W. T., 121, 138, 167.
Hummingbird, dates of migration and nesting, 62; killed by cats, 140; method of feeding young, 37; nest of, 28; winter home of, 5.
Hunting contests, 164.

Identification of birds, 49.
Incubation, 33.
Injurious birds, 110, 111.
Insects, beneficial destroyed by birds, 106; harm done by, 68; kinds eaten by birds, 74; nature's check on, 70; number eaten by birds, 73, 74, 77, 78; power of reproduction of, 70.

Jay, blue, date of nesting, 61; economic status, 112; enemy of other birds, 129, 131; food of, 115; nest-robber, 108; number killed by cats, 140.
Job, Herbert K., 184, 272, 273, 278.
Johnson, C. A., 166.
Judd, Sylvester D., 80, 110.
Junco, slate-colored, dates of migration, 61; food of, 115; number killed by cats, 140.

Kennard, Frederic H., 255, 267.
Killdeer, insects eaten by, 82.
Kingbird, beneficial insects eaten by, 106; dates of migration and nesting, 61; economic status of, 112; food of, 115; kinds of insects eaten by, 74, 82; number in United States, 126; table of nesting-habits, 35, 36; winter home of, 6.
Kingfisher, dates of migration and nesting, 61; nest of, 28; table of nesting-habits, 35.
Knot, 120.

Lacey Act, 193.
Ladd, Neil W., 136, 156, 246.
Lark, horned, food of, 115; kinds of insects eaten, 74, 83; weed seeds eaten by, 87.
Laysan Island, tragedy on, 170.
Legislation, history of, 178, 188–89.
Lessons on birds, on Audubon Society, 313–14; on Baltimore oriole, 310–11; on bluebird, 310; on colors of birds, 312; on fountains, 311; on hawks and owls, 314–15; on national government, 315; on nesting-box for wren, 303–04; on nesting-materials, 312; on open box for robin and phœbe, 313; on robin, 314; on size of birds, 313; on winter birds, 311–12.
Liberty Bell Bird Club, 215–56, 293, 295.
Litchfield, E. H., 220.
Literature and birds, 297.
Longspur, Lapland, destruction of, 133–34.

McIlhenny, Edward A., 219, 277.
McLean, George P., 194.
Market shooting, 167–68.
Marsh Island reservation, 220.
Martin, purple, attacked by English sparrow, 153; dates of migration and nesting, 61; destruction by storms, 134; house for, 243–44; house in school-yard, 289; insects eaten by, 82, 83.
Mathews, F. Schuyler, 17.
Meadowlark, dates of migration and nesting, 62; economic status of, 112; food of, 115; number killed by cats, 140; trio by, 20.

Meriden Bird Club, 209–10.
Merriam, Dr. C. Hart, 93, 97, 192.
Migration, causes of, 10; changes due to, 2; distances of, 4; records of, 1; regularity of, 3; routes of, 7; speed of, 6; time of, 7, 61, 62.
Migratory bird law, advantages of, 196–97; passage of, 193–95; regulations for, 197–202; text of, 195–96.
Miller, Newton, 155.
Millinery, birds killed for, 168–70.
Minnetonka Bird Sanctuary, 220–21.
Mosquitoes, eaten by birds, 81–82.
Moulting, 44.
Moving counter, 256–58.
Music of birds, recording, 16; similarity to human music, 18.

National Government, work of, 192–208; lesson on, 315.
Nesting-boxes, birds using, 226–27; cement, 231; comparison of types, 231; dealers in, 246–48; entrance hole, 234–35; for children, 287; height to put out, 238; in school-yard, 289; lesson, 303; location of, 237; method of fastening, 238; movable covers, 235; need of, 225; open, 241–42, 313; pottery, 231; putting out, 236; protection from cats, 239; protection from English sparrow, 240; roofing-paper, 231; size and shape of, 233; table of, 243; time to put out, 236; tin, 230; types of, 227.
Nesting-dates, 61–62.
Nesting-habits, study of, 57.
Nesting-materials, 244–45; lesson on, 312.
Nests, location of, 27; materials in, 29; shape of, 29; time of building, 27, 30.
Nighthawk, dates of migration and nesting, 61; economic status of, 113; kinds of insects eaten by, 74, 82; table of nesting-habits, 35; winter home of, 6.
Nuthatch, white-breasted, date of nesting, 61; song of, 16.

Oldys, Henry, 18.
Oriole, Baltimore, dates of migration and nesting, 61; economic status of, 113; food of, 115; lesson on, 310; nest of, 28, 29; nesting-material for, 245; number killed by cats, 140; sexual differences in color, 46; table of nesting-habits, 35, 36; winter home of, 5.
Ornithologists, 221.
Osborne, Dr. Caroline A., 147.
Osprey, 33.
Outline of bird-study, 304–09.
Oven-bird, dates of migration and nesting, 62; nest of, 27; song of, 16.
Owl, barn, 92.
Owl, barred, 96, 103.
Owl, great horned, 93, 95, 96, 103, 107.
Owl, long-eared, 92, 96.
Owl, screech, 96.
Owl, short-eared, 96.
Owls, beneficial, 94; food-chart of, 96; money value of, 97.

Parks, Military, 207; National, 207.
Paroquet, Carolina, 120.
Pearson, T. Gilbert, 138, 177.
Pease, Charles H., 138.
Pewee, wood, beneficial insects eaten by, 106; dates of migration and nesting, 62; economic status of, 112; food of, 115; kinds of insects eaten by, 74, 82, 83; song of, 18.
Phalarope, Northern, insects eaten by, 82.
Pheasants, rearing, 274.
Phœbe, beneficial insects eaten by, 106; dates of migration and nesting, 62; economic status of, 112;

food of, 115; kinds of insects eaten by, 74, 82, 83; nest of, 29, 32; open shelter for, 242; table of nesting-habits, 35, 36.
Photography, 59.
Pictures of birds, 280.
Pigeon, passenger, 117–20.
Plover, golden, 120.
Plover, upland, 120.
Poultry, destruction of by birds, 103.
Pratt, Albert H., 144.

Quail. See Bob-white.

Redstart, and cowbird, 31; dates of nesting and migration, 62; number of insects eaten by, 73.
Regurgitation, 37.
Reservations, national bird, 204–07; private, 218–21; state, 208.
Residents, permanent, 61; summer, 2, 62; winter, 2, 62.
Rice-fields, bobolink in, 102.
Roberts, Dr. T. S., 133.
Robin, attacked by English sparrow, 153; dates of migration and nesting, 62; economic status of, 112; food of, 66, 67, 115; fruit eaten by, 99; lessons on, 313, 314; nest of, 29; number and kinds of insects eaten by, 73, 74; number in United States, 126; number killed by cats, 140; number of broods, 32; open houses for, 242; slaughtered in South, 166; song of, 17, 23; speed of migration of, 6; table of nesting-habits, 35, 36; time of singing, 14; time to build nest, 30.
Rodents, harm done by, 91.
Roosevelt, Theodore, 204.

Sage, Mrs. Russell, 220.
Sanctuaries, 185; Birdcraft Sanctuary, 186–87.
Sandpiper, pectoral, 120.
Sapsucker, economic status of, 111; harm done to trees by, 104–06.
Shaler, Nathaniel S., 151.
Shrike, 107.
Shrubs, for food, 264; for nesting-sites, 264; for shelter, 263.
Sight of birds, 9.
Size of birds, lesson on, 313.
Songs, classification of, 21; season of, 13; study of, 56; time of day of, 14; variations in, 23.
Sparrow, chipping, dates of migration and nesting, 62; food of, 115; nest of, 28, 29; number killed by cats, 140; period of incubation, 33; time of singing, 14; weed seeds eaten by, 87, 88.
Sparrow, English, economic status, 111; enemy of other birds, 129; food of, 115; grain eaten by, 101; nest-robber, 108; number in United States, 126; number killed by cats, 140; number of broods, 32; poisoning, 156–59; protection of nesting-houses from, 240–41; protection of winter birds from, 258–59; shooting, 155–56; table of nesting-habits, 35; trapping, 159–60; ways in which harmful, 152–54.
Sparrow, field, duet by, 20; food of, 115; nest of, 28; weed seeds eaten by, 88.
Sparrow, song, dates of migration and nesting, 62; food of, 115; number killed by cats, 140; open shelter for, 242; table of nesting-habits, 35, 36; time of singing, 14; weed seeds eaten by, 87.
Sparrow, tree, dates of migration, 61; weed seeds eaten by, 88, 89.
Sparrow, vesper; dates of migration and nesting, 62; food of, 115; song of, 23; weed seeds eaten by, 87.
Sparrow, white-throated, dates of migration, 61; song of, 17.
Sportsmen, shooting by, 162–65.
Squirrel, red, 42, 130.
Starling, 108.

State governments, work of, 188–91.
Suet-box, 254.
Swallow, bank, insects eaten by, 82; nest of, 28.
Swallow, barn, dates of migration and nesting, 62; insects eaten by, 82, 83; nest of 29; number killed by cats, 140; open shelter for, 242; winter home of, 6.
Swallow, cliff, insects eaten by, 82; route of migration, 8.
Swallow, tree, feeding young, 36; insects eaten by, 82; nesting-box for, 243.
Swallow, violet-green, insects eaten by, 82.
Swan, trumpeter, 120.
Swift, chimney, dates of migration and nesting, 62; insects eaten by, 82; nest of, 28; return to nesting-site, 28.

Tanager, scarlet, dates of migration and nesting, 62; insects eaten by, 73; moulting of, 44, 45, 46.
Tariff regulations on plumes, 203–04.
Tern, Arctic, 5.
Thrasher, brown, dates of migration and nesting, 62; economic status of, 112; food of, 115; fruits eaten by, 99; number in United States, 126; song of, 23.
Thrush, hermit, location of nest of, 27; song of, 23, 24.
Thrush, wood, dates of migration and nesting, 62; food of, 115; song of, 19, 24; table of nesting-habits, 35.
Towhee. See Chewink.
Traps, for cats, 247; for sparrows, 159–60, 247.
Trees, damaged by sapsucker, 104.
Trios among birds, 20.
Turkeys, 274.

Uehling, Edward, 257–58.

Veery, dates of migration and nesting, 62; song of, 23.
Vireo, red-eyed, dates of migration and nesting, 62; duration of singing, 14; feeding young, 36; number of insects eaten by, 73; winter home of, 6.
Vireo, warbling, dates of migration and nesting, 62.
Vireo, yellow-throated, insects eaten by, 82, 83.
Visitants, transient, 2.

Walter, Mrs. Alice H., 151.
Warbler, chestnut-sided, song of, 16.
Warbler, Nashville, number of insects eaten by, 73.
Warbler, yellow, and cowbird, 31; dates of migration and nesting, 62; insects eaten by, 73, 82; number killed by cats, 140.
Ward, Charles W., 219.
Water-plants for ducks, 276.
Waxwing, cedar. See Cedar-bird.
Weasels, 129.
Weathercock food-house, 256.
Weed seeds, dispersal of, 85; kinds eaten by birds, 87; number eaten by birds, 88; number of, 85; vitality of, 85.
Weeds, harm done by, 84.
Weeks, John W., 194.
Whip-poor-will, insects eaten by, 82.
Willet, 120.
Window box, 256.
Window shelf, 254.
Winter birds, feeding, 249–59; study of, 58; lesson on, 311–12.
Winter homes of birds, 5.
Woodcock, 47, 120.
Woodpecker, downy, date of nesting, 61; food of, 115; nesting-box for, 243; number and kinds of insects eaten by, 74.
Woodpecker, hairy, food of, 115; number and kinds of insects eaten by, 74.

Woodpecker, red-headed, economic status of, 112; food of, 115; kinds of insects eaten by, 74; nesting-box for, 243; plumage of nestlings of, 46.
Worthington, Charles C., 219.
Wren, Bewick's, song of, 20.
Wren, house, attacked by English sparrow, 153; dates of migration and nesting, 62; duration of song-period, 14: economic status of, 113; food of, 115; lesson on, 303–04; nest of, 29; nesting-box for, 243; number in United States, 126; number killed by cats, 140; number of broods of, 32; rearing young, 38–41; song of, 22; table of nesting-habits, 35, 36; time of building nest, 30.
Wren, marsh, dates of migration and nesting, 62; insects eaten by, 76; nest of, 28, 30.
Wren-tit, insects eaten by, 82.

Yellow-throat, Maryland, dates of migration and nesting, 62; number of insects eaten by, 73; song of, 16.
Young birds, feeding, 35; food of, 36; time in nest, 34; value of, 76.

The Riverside Press
CAMBRIDGE . MASSACHUSETTS
U . S . A

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

AN INITIAL FINE OF 25 CENTS
WILL BE ASSESSED FOR FAILURE TO RETURN
THIS BOOK ON THE DATE DUE. THE PENALTY
WILL INCREASE TO 50 CENTS ON THE FOURTH
DAY AND TO $1.00 ON THE SEVENTH DAY
OVERDUE.

BIOLOGY LIBRARY

OCT 6 1932
OCT 1 1937
OCT 26 1937
MAY 17 1949
JUN 6 1959
6 Je'59 K

LD 21-3m-6,'32

iKu b
rso net

U.C. BERKELEY LIBRARIES
C026148980

364842 QL673
T7
BIOLOGY
LIBRARY
G

Trafton

UNIVERSITY OF CALIFORNIA LIBRARY